Abstract
Effectively visualizing social and humanities research through geographic data poses a unique set of challenges. This paper aims to streamline the data analysis process by identifying optimal visualization methods. We detail the data collection procedures for geographic information display and explore various research methods applicable to visualizing such data. The primary objective is to enhance the presentation of social and humanities research outcomes through geographic information visualization. Our approach encompasses web pages, two-dimensional, three-dimensional, as well as VR and AR interaction methods, serving as the control group. The paper evaluates strategies to make data presentations more impactful and optimizes data processing methods.

Keywords
Geographic Information System; Data Visualization; Humanities Research; Virtual Reality; Augmented Reality

Introduction
In the realm of research and teaching focused on social and humanistic information, conveying findings typically relies on verbal or text descriptions and video presentations. However, these conventional modes often lack visual impact or interactivity. Despite the potential of geographic information visualization, its adoption remains limited compared to text and video displays (Bo Zhao, 2020). Technological barriers, such as satellites, software, and equipment, have historically hindered widespread utilization. Nevertheless, advancements in science and technology have seen increased integration of Geographic Information System (GIS) technology in various scenarios, supported by user-friendly software. This has made leveraging geographical information for humanities and social data display more reliable and convenient. Despite this progress, users still require a comprehensive understanding of available methods and software applications. This article introduces current methods based on real projects, aiming to empower researchers in effectively showcasing their findings and harnessing the potential of science and technology in humanities disciplines.

GIS with humanities & social research
The utilization of Geographic Information Systems (GIS) to present humanities information offers several advantages. GIS facilitates the spatial conceptualization of research topics, allowing for the quantification and analysis of social, cultural, and historical data in innovative ways (Kong et al., 2021). As a repository of information, GIS operates on the platform of our living Earth, encompassing geological transformations and all entities residing within this space. Given that the study of humanities and society spans not only specific points but also time periods and processes, GIS emerges as an effective solution, enhancing the methodologies of humanities and societal research.

This approach is beneficial for two primary reasons. Firstly, it contributes to the visual aspect of presenting information. Traditionally, humanistic information relies on text descriptions fixed at specific times and locations, such as 'Britain in the 18th century' or 'Ancient Greece in BC.' This approach provides clarity to research content and immerses readers in a defined space. As Wang et al. (1996) state, "Humans can perceive their spatial surroundings both by visual and auditory senses," aligning with our evolutionary need to perceive the environment for survival. Therefore, humanities research has always incorporated time and space to create an environment that readers can familiarize themselves with before delving into the content.

Secondly, GIS aids in the storage of spatial information, contributing to the preservation and passing on of cultural records. Humanities, often intertwined with the arts, hold societal value in their contributions to the economy and well-being, playing therapeutic roles (Smith, 2015). While written information has limitations in preservation and sharing, visual presentations can address these constraints. However, the humanities face challenges in attracting funding from sources such as research councils or industry, potentially jeopardizing their perceived effectiveness.

To overcome these challenges and enhance research impact, incorporating more visually impactful and technology-linked methods can provide a breakthrough. By leveraging GIS for spatial analysis and visualization, humanities researchers can present their findings in ways that captivate audiences, making their work more accessible and impactful in a world increasingly focused on visual communication.

Data Collection

Before commencing the research process, it is crucial for the researcher to clearly define the intended purpose. There are two primary objectives: personal research and presentation.

In the case of personal research, the most commonly employed method involves the utilization of visuals, where collected information is intricately integrated into a map. This approach proves particularly effective when crafting articles, posters, and delivering course demonstrations. The emphasis here lies in creating informative and visually engaging materials.

On the other hand, the presentation aspect is tailored for researchers participating in conferences, aiming to showcase their research outcomes. Methods employed in this scenario are often technology-centric, prioritizing the incorporation of technological elements and visual art effects. The overarching goal is to enhance audience engagement, fostering increased interest, and facilitating student researchers in acquiring deeper insights. Leveraging technology products serves as a valuable aid in the research process, elevating the overall effectiveness of presentations and knowledge dissemination.

Initiating the data collection process is the foundational step once the research direction is clearly understood. This initial phase is crucial as subsequent analysis and processing heavily depend on the availability of robust geographical information data. The primary emphasis during data collection is on location information, where longitude and latitude emerge as the two pivotal data sets requiring collection.

For singular locations, a single set of longitude and latitude suffices to pinpoint the precise location. In contrast, when dealing with broader areas, a minimum of three longitude and latitude coordinates becomes essential for accurate delineation. Authenticity in data collection is paramount, as any errors or false information may introduce inaccuracies into the research findings.

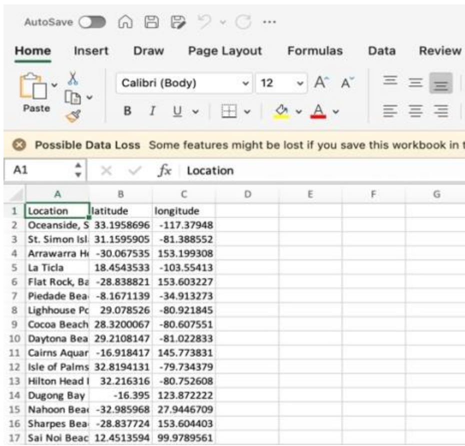
In contemporary times, advancements in satellite technology have rendered on-site mapping obsolete. Geographical locations can now be conveniently accessed through online platforms such as Google Maps, exemplified by coordinates like (32.2333, -110.953). The degree of detail in geographical information increases with the number of decimal points.

Once these geographical data points are amassed, Excel proves to be an effective storage solution. While there is no rigid file format requirement, maintaining consistency in the record format is crucial for subsequent Python-based data extraction. This ensures a seamless and efficient retrieval process, enhancing the overall efficacy of the research endeavor. The integration of advanced technologies not only streamlines precise data collection but also facilitates subsequent data management and analysis.

File Formats for Collected Data

While I previously mentioned using Excel for data collection, it's essential to note that the format is not limited to Excel. The choice of Excel is primarily due to its concise tabular structure, facilitating subsequent data processing. The key takeaway here is that a concise table structure significantly aids in data processing. A common alternative is the CSV (Comma-Separated Values) file format. CSV is widely used because it serves as a universal exchange format for data. Although it often requires cleanup in GIS packages to ensure correct data type conversion for each record field (Christina et al., 2020), CSV files enjoy broad compatibility with various GIS software, making them directly readable by most platforms. CSV files can be easily created and formatted in Excel before conversion.

Another file format to consider is GeoJSON. GeoJSON is a JSON-based format specifically designed to represent geographic features along with non-spatial attributes. Notably, an object in GeoJSON can represent various geometries, including points, line strings, or polygons (Steiniger et al., 2016). In practical terms, when dealing with point coordinates, such as specific geographical locations (e.g., cities, towns), CSV files are recommended due to their tabular nature. On the other hand, when analyzing regions, a GeoJSON file is commonly used to delineate the geographical boundaries (e.g., states in a country). GeoJSON files can be sourced online or created using free map software, allowing users to draw required areas with lines and export the resulting file. An additional advantage of GeoJSON files is their direct usability in code writing, providing flexibility in data manipulation and analysis.



	A	B	C
1	Location	latitude	longitude
2	Oceanside, S	33.1958696	-117.37948
3	St. Simon Isl	31.1595905	-81.388552
4	Arrawarra H	-30.067535	153.199308
5	La Ticla	18.4543533	-103.55413
6	Flat Rock, Ba	-28.838821	153.603227
7	Piedade Bea	-8.1671139	-34.913273
8	Lighhouse Pc	29.078526	-80.921845
9	Cocoa Beach	28.3200067	-80.607551
10	Daytona Bea	29.2108147	-81.022833
11	Cairns Aquar	-16.918417	145.773831
12	Isle of Palms	32.8194131	-79.734379
13	Hilton Head I	32.216316	-80.752608
14	Dugong Bay	-16.395	123.872222
15	Nahoon Bea	-32.985968	27.9446709
16	Sharpes Bea	-28.837724	153.604403
17	Sai Noi Beac	12.4513594	99.9789561

（Figure1: CSV file example ）

```
{
 "type": "FeatureCollection",
 "features": [
  {
   "type": "Feature",
   "properties": {},
   "geometry": {
    "coordinates": [
     [
      21.38800863859251,
      3.8600501965954805
     ],
```

(Figure 2: GeoJSON Example)

In addition to the previously mentioned file formats like CSV and GeoJSON, there exists a plethora of alternative formats such as XML, DBF, KMZ, each catering to diverse data requirements. Noteworthy among these is Excel's. Xlsx format. This format becomes particularly relevant in scenarios where input information is point-based, involving hotspot maps or coordinate-centric geographical data that entails handling substantial data volumes.

The challenge arises when we possess only the names of geographical locations without their specific coordinates, necessitating a laborious manual input process. To streamline this, there is a method to automatically populate the coordinates. Crucially, whether using an xlsx or CSV file, it's imperative to include a header row in the first row of the table. This header is essential for software to correctly interpret and read the data. As an example, a simple set of three headers like 'Location', 'Latitude', and 'Longitude' could be employed.

Suppose we only have information on the 'Location' among the three headers, which is the name of the place (e.g., 'Third Street Elementary School', 'Alice's Restaurant'). These names are then entered into the first column of the Excel table. The next step involves registering and obtaining a Google Maps API. Subsequently, Python pandas can be utilized to read and process the file. Through a dedicated code, a file containing specific geographical coordinates can be seamlessly exported, significantly simplifying the otherwise cumbersome process. This automated approach not only enhances efficiency but also reduces the margin for errors in the manual input of extensive geographical data.

```
pip install pandas

pip install geopy

pip install googlemaps

import pandas as pd
from geopy.geocoders import GoogleV3
import geopy.distance
import googlemaps

API='[illegible]'

#geolocator = GoogleV3(api_key=API)
print(type(geolocator))

#name='Oceanside, San Diego County'
#location=geolocator.geocode(name)
#print(location.address)
#print(location.latitude,location.longitude)

file = '6000.xlsx'
df = pd.read_excel(file)
locations = df['Location']

location_dict = {'location':[], 'latitude':[], 'longitude':[]}
for location in locations:
    # if adress is not []
    if not pd.isna(location) and location[0] != ' ':
        res = geolocator.geocode(location)
        location_dict['location'].append(res.address)
        location_dict['latitude'].append(res.latitude)
        location_dict['longitude'].append(res.longitude)
# save data to the Excel
save_df  = pd.DataFrame(location_dict)
save_df.to_excel("result.xlsx", index=False)
```

(Figure 3: Code use google api add lag and long)

As mentioned in the previous content, it is important to create a list name because the list title is needed in the following code:

```
location_dict = {'location':[], 'latitude':[], 'longitude':[]}
    for location in locations:
     # if adress is not []
     if not pd.isna(location) and location[0] != ' ':
         res = geolocator.geocode(location)
          location_dict['location'].append(res.address)
          location_dict['latitude'].append(res.latitude)
          location_dict['longitude'].append(res.longitude)
```

The method employed here leverages the geocoding function within the Google Maps API. Geocoding, in the context of the Google Maps API, is the process of transforming addresses into geographical coordinates. This streamlined process involves sending requests to the backend database via code. Once authenticated with the API user credentials, permission is granted to access the requested data, which is then retrieved and printed within the code. Finally, the data is exported.

It's important to highlight the simplicity and efficiency of this approach, effectively saving time and mitigating errors associated with manual data input. However, it's crucial to acknowledge that the automated generation of data may introduce inaccuracies. These errors can stem from factors such as identical address names, incorrect data in the backend database, or limitations in the accuracy of address identification (Singh, S. K., 2017). Despite these potential challenges, the geocoding function remains a valuable tool for its overall efficiency and reduction of manual input-related errors in geographical data handling.

Available software

The careful selection of GIS software is a pivotal step in project execution, wielding a significant influence on the efficacy of research endeavors (Eldrandaly, 2007). Expanding on our previous mention of Excel, it's worth noting that Excel, alongside counterparts like Tableau, inherently possesses foundational GIS capabilities. These tools, primarily employed for commercial display purposes, share core functionalities.

Visualizing data on maps, using points or hotspots, and employing distinct colors to convey information and depict density and distribution patterns are among the basic features. With each addition of information, a new layer is introduced, utilizing various lines, points, and colors to represent unique variables (Faust, 1995).

Beyond their visual prowess, these tools serve as effective entry points for data information, streamlining both data input and subsequent secondary analyses. They stand out as valuable choices for simplifying the representation of complex geographical data through clear visualizations. As technology progresses, these software tools not only excel in presenting information visually but also serve as user-friendly interfaces, facilitating seamless data manipulation and analysis within the GIS domain. Their versatility positions them as powerful assets in enhancing both project efficiency and the clarity of geographical data representation.

The exploration of programming software introduces two primary methods for displaying GIS maps. The first involves utilizing libraries, exemplified by programming languages like R. These libraries offer a wealth of vector maps within the database, enabling seamless code-based connections to retrieve valuable information. The second method integrates elements through code, where geographical images uploaded in documents are read. This involves photo information as a layer and utilizing code to modify images or add layer details.

When employing code for GIS information processing, the focus extends beyond visual presentation to encompass database analysis. Beyond layers, code introduces another crucial functionality—scripts. These scripts, when coupled with layers, generate novel visual effects and functions. (Aydin,2024) Executing code to run function results, returning messages to the layer, establishes an information feedback loop, fostering interactive communication between users and the interface.

A prime example highlighting this concept involves the synergy of HTML and C#. HTML, serving as a web page code, adeptly retrieves database information and seamlessly integrates with designated GIS software to construct interactive layers. This dynamic interplay not only elevates visual representation but also fosters significant user engagement with GIS data. The integration of code thus presents a versatile toolkit, contributing to both the visual allure and the robust data analysis capabilities within the GIS domain.

Taking Mapbox as an example of HTML, first register an account to obtain a link number. Determine the scripts you need to use in your code:

```html
<meta name="viewport" content="initial-scale=1,maximum-scale=1,user-scalable=no">
<link href="https://api.mapbox.com/mapbox-gl-js/v2.10.0/mapbox-gl.css" rel="stylesheet">
<script src="https://api.mapbox.com/mapbox-gl-js/v2.10.0/mapbox-gl.js"></script>
```

（Figure 4: mapbox script）

Then we enter the accessToken number. Because it is the database of the software, we can customize some appearances in the software, such as the color of the map, or import some drawings, layers, information and then use in code, also choose some start center of zoom level.

```html
<script>
    mapboxgl.accessToken = '
        pk.[redacted]';
    const map = new mapboxgl.Map({
        container: 'map',
        // Choose from Mapbox's core styles, or make your own style with Mapbox Studio
        style: 'mapbox://styles/[redacted]
        zoom: 4.31,
        center: [-[redacted]]
    });
```

(Figure 5: mapbox accessToken)

The most important thing to use code is to implement functions. For example, the function implemented in this part is to provide key options to allow users to select the information layer to be displayed.

```javascript
// Show or hide layer when the toggle is clicked.
link.onclick = function (e) {
    const clickedLayer = this.textContent;
    e.preventDefault();
    e.stopPropagation();

    const visibility = map.getLayoutProperty(
        clickedLayer,
        'visibility'
    );

    // Toggle layer visibility by changing the layout object's visibility property.
    if (visibility === 'visible') {
        map.setLayoutProperty(clickedLayer, 'visibility', 'none');
        this.className = '';
    } else {
        this.className = 'active';
        map.setLayoutProperty(
            clickedLayer,
            'visibility',
            'visible'
        );
    }
};
```

(Figure 6: Functional code)

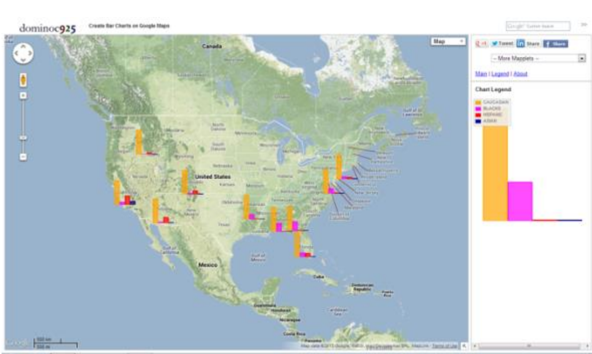
These are the three foundational steps: First, insert the script. Second, establish connections. Third, bring the function to life. It's crucial to emphasize that this process goes beyond mere image presentation; it enables the incorporation of three-dimensional geometric figures into the map layer. This introduces a transformative aspect, shifting the displayed map information from a two-dimensional format to a robust three-dimensional data structure. This technological leap is particularly noteworthy when utilizing tools such as C# and Unity.

Much like the intricate maps within gaming environments, the C# language empowers GIS with robust capabilities. Through templates and scripts, it facilitates the creation of dynamic three-dimensional visuals, seamlessly blending real-world and fictional elements. Yet, the true essence lies in the transformative approach it introduces to GIS information presentation.

Data Visualization

To recap, the main goal of geographic information is to visualize data and facilitate analysis by researchers. Traditionally, this involves layering on a two-dimensional map, using vector data to represent the scale of the data. However, the introduction of three-dimensional images brought a paradigm shift. 3D images not only guide users to understand the structure of the data, but also serve as a comprehensive collection of data containing details such as buildings, mountains, rivers, and more.

Take drone aerial photography and Google Maps' 3D street images as examples. These visuals carry a wealth of information. Drone aerial photography can convert images into three-dimensional representations and seamlessly integrate them into two-dimensional maps. So, the question is: why should we integrate three-dimensional maps into two-dimensional maps? For example, local population information is presented through a bar chart. While adding histograms to a 2D map may impact visual aesthetics and require scaling, 3D histograms are seamlessly integrated into the 2D map screen, providing a smoother and visually pleasing experience. This integration represents a significant advancement in enhancing the effectiveness of GIS data visualization and analysis.



(Figure 7: 2D bar graph)

(Figure 8: 3D bar graph)

When GIS incorporates three-dimensional geometry, it transcends mere data display to delve into data analysis. To simplify, consider the distinction between two-dimensional and three-dimensional graphics. Two-dimensional graphics have a single side, while three-dimensional graphics boast multiple sides observable from different angles, akin to the disparity between a triangle and a triangular pyramid.

Imagine dividing the triangle into three sections: upper, middle, and lower, with varying colors denoting the percentage of a study within each section. In this scenario, we have three sets of data. Now, envision a three-dimensional image, and the data expands exponentially. With multiple angles and facets, we now have nine sets of data, enhancing the depth and granularity of our analytical capabilities. The transition to three-dimensional representation in GIS not only amplifies the visual experience but also empowers a more comprehensive and nuanced analysis of complex data structures.

Extending beyond its traditional role in data display, 3D GIS unfolds unexpected applications. In forensic archaeology, for instance, GIS technology is harnessed to conduct meticulous scans and analyses of skeletal remains within a controlled environment (Voeller, 2024). This innovative use reflects a paradigm shift in how users perceive GIS, broadening its scope. While GIS is conventionally associated with mapping expansive environmental contexts, the analysis of skeletons necessitates a shift in dimensionality.

This transformation goes beyond the information content, also altering the spatial scale. Traditionally, GIS dealt with larger-scale distances measured in kilometers. However, with the introduction of three-dimensional GIS, the spatial environment for analysis can now be as confined as the size of a room. Notably, this shift is not just about space but also about precision. Geographical information positioning, once measured in kilometers, has evolved to centimeters in the realm of three-dimensional GIS. This evolution provides a nuanced spatial framework for analyzing datasets in detailed and confined settings, marking a substantial advancement in GIS capabilities.

GIS functionality relies on satellite positioning, a technology commonly employed in vehicles. Take Tesla cars as an example; their current user interface integrates three-dimensional geographical information, allowing users to utilize coordinates for precise navigation. This capability is not confined to vast outdoor spaces; it can be seamlessly scaled down to the dimensions of a room. Consider a scenario where a robot needs to navigate from room A to room B. Similar to car navigation, the robot relies on coordinates to determine its location accurately. In essence, precise GIS applications play a pivotal role in facilitating such navigational tasks.

Certainly, there are instances where all our data deviates from actual satellite coordinates and instead adopts a grid-like structure resembling a chessboard, featuring X, Y, and Z axes. The determination of location coordinates on a small map, commonly employed in games or virtual presentations, underscores this shift. In this process, the concept of geographical information undergoes a transformation into location information. Location information introduces more specific data structures, such as distinct parts of a cow, highlighting the distinction between location information and geographical information. Another exemplar is the location map used for seat selection on an airplane. This map, devoid of geographical information and independent of satellites, functions as a coordinate-based map.

Examining these two examples reveals that when researchers engage with GIS, they have more than just geographical data at their disposal—location information stands out as a valuable alternative. This realization underscores the versatility of GIS, providing researchers with the means to showcase various research methods and explore future possibilities.

Showcase

After wrapping up their research, one of the essential considerations for a researcher is how to effectively present their findings. GIS information display can be broadly categorized into three types: photo display, web page interactivity, and VR/AR display.

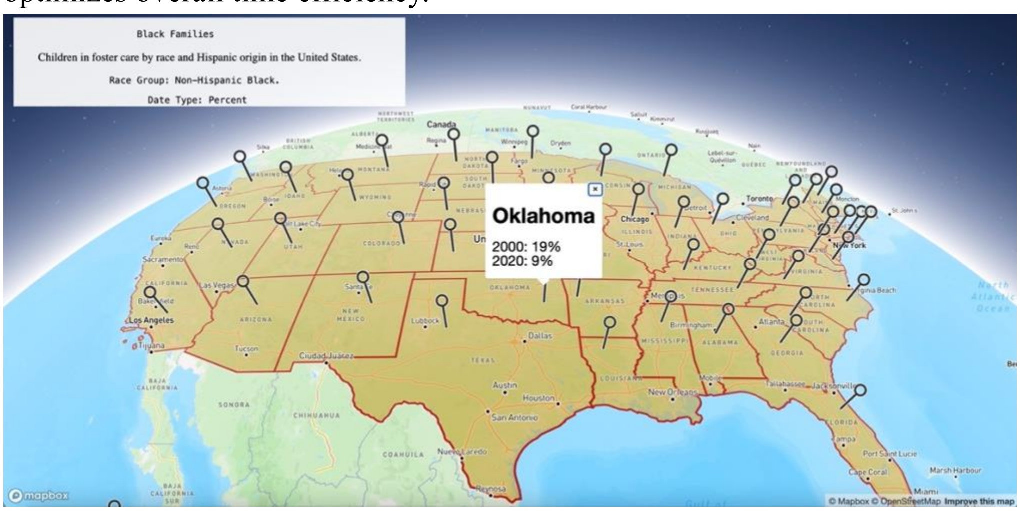
Let's delve into the first type—photo display. This mode stands out for its simplicity, requiring minimal code from researchers in the initial stages. Their main task revolves around importing data into the map. The critical aspects include data processing and map design, incorporating elements such as colors and geometric shapes to identify locations. However, the utmost importance is placed on optimizing the information on the map (Abdurakhmonov, 2020). The primary objective is to engage users, facilitating their understanding of the research through maps and providing a clear representation of research information in this visual format. This method is mostly used for article publication and poster or PPT presentations.

Interactive web pages represent the predominant mode of presentation in today's digital era. The shift from traditional paper maps to online platforms is evident, with most internet-based software featuring essential interactive functionalities, often centered around zooming in or out—a straightforward yet effective means of interaction. The utilization of interactive web pages offers two notable advantages. Firstly, it elevates audience engagement, transforming passive readers into active explorers of map information through diverse devices, including computers.

However, challenges may arise during presentations where only one device is available for interaction. To address this issue, a pragmatic solution involves modifying the web code, encompassing not just HTML or CSS but also codes like JS and VUE applicable to web pages. Researchers can then publish the adjusted code on hosting servers such as GitHub. Subsequently, they can convert the link into a QR code using an online generator. This facilitates audience access to the interactive web page through their mobile devices, such as phones, by simply scanning the QR code. This approach ensures broader participation and engagement, overcoming limitations associated with a single device during lectures.

The second pivotal aspect centers on a substantial amplification of information. Beyond the intrinsic features of the web page, focusing solely on the map allows for seamless integration of additional layers of information. Users engaging with the interactive map can click on specific elements, unveiling dialog boxes that provide more in-depth insights. Alternatively, developers can leverage interface guidance to expedite users' comprehension of the research content.

As highlighted earlier, the incorporation of map information equates to an augmentation in layers. Each added layer acts as an overlay of information, and the interactive web page empowers users to dynamically zoom in and out—an operation akin to addition and subtraction. To be more specific, zooming in allows developers to employ code for the display of specific information, while zooming out discreetly conceals this information. This not only contributes to maintaining a lucid interface but also elevates the web page's refresh speed. It mitigates the risk of information overload, circumvents delays in content presentation during lectures, and optimizes overall time efficiency.

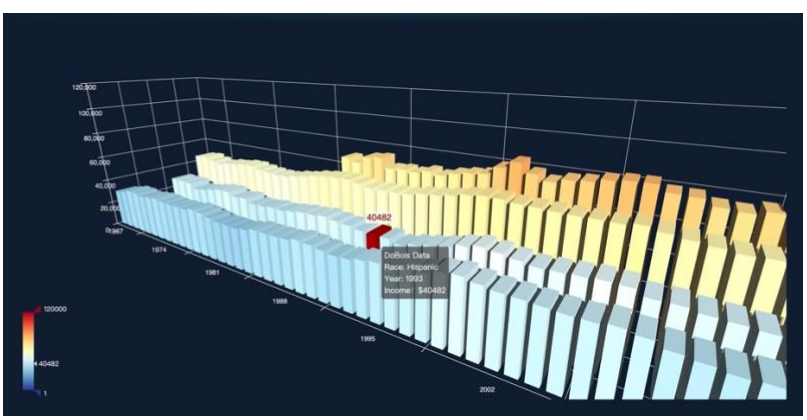


(figure 9: Map with dialog boxes)

The third aspect revolves around VR and AR demonstrations. Despite sounding like futuristic technology, current methods make these demonstrations accessible. For VR, the requirement involves purchasing specific equipment, whereas AR seamlessly integrates with mobile phones, offering significant cost savings for research endeavors. To grasp the distinction, VR constructs a virtual environment, immersing users within it. On the other hand, AR blends virtual content into actual scenes. The integration of GIS and AR represents an innovative endeavor and sets a future direction for AR development. This transition involves moving from the overlay of two-dimensional layers to the overlay of three-dimensional coatings—shifting from virtual layers to tangible, real-world layers. AR, in this context, has the capability to supplement real scenes with additional information, thereby enhancing overall perception (Safari Bazargani, 2022).

An effective solution involves leveraging the device for navigation, displaying relevant information directly on AR glasses or mobile phones, akin to the head-up display commonly used in modern cars. Another application is in the realm of entertainment, exemplified by Snapchat's AR media. Users have the capability to position virtual models in specific geographical locations and subsequently share these augmented updates on social media (Daubs, 2021). This not only generates user traffic but also contributes to business growth and enhances the local economy. Furthermore, AR holds immense potential for the advertising industry, facilitating a more immersive dissemination of historical and cultural narratives (Dodoo, 2021). In the domain of humanities research, the integration of AR and GIS provides a powerful means to effectively communicate historical changes, adding a dynamic layer to the exploration and understanding of historical events. Notably, the GeoCAST function in worldcast.io stands out as a compelling example of GIS-AR integration. This software empowers users to input diverse elements such as text, images, and videos, situating them on specific locations on a genuine satellite map. Subsequently, the software generates a QR code for effortless scanning, enabling users to explore and engage with the curated content seamlessly.

Lastly, in terms of location information, when satellite positioning is unnecessary, VR provides an avenue to showcase a dataset or a virtual space. Consider a scenario where a researcher explores humanistic changes from villages to cities in the Danube River Basin. VR can be employed to create a virtual geographical environment, allowing the researcher to practically immerse themselves in the humanistic information, presenting it akin to a cinematic sequence. Alternatively, data can be transformed into a three-dimensional model, providing users with an immersive experience as if navigating through a data ocean. VR proves particularly effective in displaying dynamic data models (Lyu, 2024).



（Figure 10: 3D data showcase）

Conclusion

Throughout this text, we delve deeply into the extensive utilization of Geographic Information System (GIS) technology in social and humanities research, offering a systematic exploration of various visualization methods. The integration of GIS not only enhances the effectiveness of data presentation but also furnishes humanities scholars with novel tools and perspectives.

The transformative potential of GIS becomes evident in fostering a more intuitive grasp of social and humanities data. Through the seamless amalgamation of interactive web pages, 3D GIS, and virtual/augmented reality (VR and AR) technologies, researchers gain the capability to showcase their findings in a more creative and profound manner. This not only amplifies the impact of their research but also makes intricate humanities content more accessible.

In the rapidly evolving landscape of technology, the application of GIS in humanities research continues to hold immense promise. Anticipated developments include the emergence of more advanced interactivity tools, refined three-dimensional representation techniques, and broader exploration of augmented reality applications. These innovations are poised to extend the frontiers of humanities research, equipping scholars with potent tools to comprehend and communicate their research more effectively.

Hence, we strongly encourage scholars engaged in humanities research to actively explore and embrace GIS technology. By delving into the untapped potential of this technology, we aspire to propel humanities research into an era characterized by richness and comprehensiveness. In this ongoing evolution, GIS will persist in opening new avenues for humanities researchers, offering robust support for a deeper understanding of human culture, history, and societal transformations.

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