[DA-047] GIS&T in International Affairs

Abstract

GIS applications within the International Affairs domain are vast, and they include: the analysis and representation of flows and stops of people, resources, and capital across borders, humanitarian assistance, war, conflict, and surveillance, and analysis of border-crossing spatial phenomena such as natural disasters and climate change.

Due to the wide range of potential thematic data, GIS for International Affairs should be a balance of hands-on practical application skills and critical thinking about spatial concepts of scale, boundaries, borders, and flows. GIS scholars and practitioners in this domain should learn to think critically about how and where spatial data is created, the people and cultures impacted by spatial data-driven decisions, and the equity of who is involved in such decisions. Students should learn how spatial data is created, how major datasets in the field are built, and how to design datasets during fieldwork for robust spatial analysis. Through all of this, critical thinking around which people and places are counted and represented should be maintained.

GIS in International Affairs must always contend with the colonial history of cartography, seeking now to understand how modern-day spatial technologies are always constituted by and embedded in constructions of power.

Keywords: geopolitics, global studies, humanitarian GIS, international data, international studies

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Explanation

1. Definitions

International Affairs: study of politics, economics, and law on a global level

2. International Data Sources and Standards

Students and scholars working in the field of International Affairs are interested in the spatial distribution and movement of people, goods, and resources between geographic places, often across borders. Relevant to the field of study is the inequal distribution of data itself. Available data sources, both in quality and thematic quantity, abound for the United States and most Western countries, but can be difficult to come by in for other areas of the world. Geographic data is crucial for informed decision-making for policy at all levels and scales. Accessible and high-quality data is needed to ascertain the most basic understandings about the world around us, such as: how many people live where, how many people are in poverty, where are jobs growing, and where do people lack access to basic resources? Given the inherent complexity of capturing and describing human populations in quantitative data, a key element of GIS in International Relations is about the process of data creation: how are spatial datasets created, where areas of the world do they capture, and who is counted in them?

A lack of useable spatial data can occur for a multitude of reasons, including insufficient funding or capacity for data collection and distribution, a lack of open data laws, or fragmented data collection efforts. When people, goods, and resources are not able to be measured and represented, it is even more difficult to understand and rectify issues fundamental inequities such as poverty, environmental injustice, lack of access to water, sanitation, and transportation, and so on. Timely and available data sources globally are needed, including geographic data not simply aggregated at the country level, but instead at the finest possible administrative planning unit. For example, spatial analysis can be used to study international migration by modeling migration routes or optimizing resettlement locations for refugees. Models can be created to show where drinking water stations should be added to migrant routes, how increased cell phone coverage in migrant areas might save lives, or to predict the most likely path a migrant would travel over physical terrain. These types of spatial analysis products require multiple variable inputs, which are likely pulled from disparate data sources and formats.

When fine-grain local data is lacking, scholars often turn to ‘big data’ sources such as satellite imagery or data acquired via mobile phone. Satellites data can be used to analyze land cover (including urbanization and forest change), climatic conditions, and nighttime lights. These datasets are valuable because of their global coverage and wide availability but lack specificity about population structure. Oak Ridge Laboratory’s LandScan Global population model is an example of this type of dataset. LandScan is a 30 arc-second raster population model with global coverage that is especially useful for population estimates in areas where subnational census estimates are not available.

In 2014, the United Nations Independent Expert Advisory Group on a Data Revolution for Sustainable Development proposed five key recommendations to work towards more equitable global data. The recommendations were to 1) develop global consensus on principles and standards, 2) share technology and innovations for the common good, 3) new resources for capacity development, 4) leadership for coordination and mobilization, and 5) exploit ‘quick wins’ on Sustainable Development Goal data. The group’s report advocates for the production of high-quality data that can be used to compares outcomes and changes over time and across geographic areas. It proposes investing in technical expertise, systems, and technologies, while seeking to build public trust and expand access and ability to use data.

One example of such efforts is the ongoing work from the United Nations Economic

Commission of Africa to integrate geographic location into the African Spatial Statistical Framework. The group has been working to make population census counts "collect spatially-enabled data that will be relevant to national, regional and international policy, planning and reporting requirements" and to incorporate National Spatial Data Infrastructures (NSDI) into the National Strategies for the Development of Statistics (NSDS) (Nonguierma 2018).

Traditional focus within the international geospatial community has focused on data and system interoperability, with the International Standards Organization (ISO) and Open Geospatial Consortium (OGC) leading these efforts. In order to facilitate data sharing across nation-states, the ISO has developed a set of international standards specifically for the field of digital geographic information. ISO "aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth," and for geographic information, these standards specify "methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting, and transferring such data in digital/electronic form between different users, systems and locations" (ISO 2021). ISO standards facilitate the sharing of data across countries, governments, and organizations.

The OGC is an international organization composed of government agencies, research organizations, universities, and business, all aligned with the goal of making geospatial data findable, accessible, interoperable, and reusable through a consensus-based process. OGC develops operates under what it terms "OGC Values," which are: 1) to be open, diverse, inclusive, and accessible, 2) to value technical excellence and innovation, 3) to be passionate about the greater good, and 4) to always honor their commitments and aim to exceed expectations (OGC 2021). OCG allows for membership at multiple levels, the highest of which is the 'Strategic' membership class, which allows members to advise the OGC Board and help "guide OGC's direction via targeted investments based on market requirements" (OGC, 2021). Strategic members include the European Space Agency, Natural Resources Canada, the UK's Ordnance Survey, and five US federal agencies: the Federal Aviation Administration (FAA), US Department of Homeland Security (DHS), US Geological Survey (USGS), US National Aeronautics and Space Administration (NASA), and the US National Geospatial-Intelligence Agency (NGA). Moving down a membership tier, OCG Principal members are given membership on the Planning Committee. These members include Airbus Defense & Space, Amazon Web Services, Esri, Google, Microsoft Corporation, and others. Technical members include Lockheed Martin, L3Harris, Abu Ghabi Digital Authority, Australia's Department of Defense, European Union Satellite Centre, Statens kartvek (Norweigan Mapping Authority), Wuhan University, and others. International businesses and organizations also join at the Associate level.

3. GIS in Humanitarian Assistance

GIS is increasingly leveraged in a humanitarian context, both for professionals who deploy in the field in the face of natural disasters and for those far away who wish to contribute to a digital infrastructure for people and places in need. Geospatial data programs designed specifically for humanitarian relief exist at all scales and are run by governmental agencies, NGOs, and are often bottom-up crowdsourcing efforts. Crowd-sourced or participatory mapping programs help facilitate self-determination around data creation (see also: Cartography and Power).

At the international level, the UNITAR Operational Satellite Applications Programme (UNOSAT) was first established in 2000 as a technology program designed to deliver satellite imagery analysis to relief and development organizations. Run by UNITAR (United Nations Institute for Training and Research) with the support of the European Organization for Nuclear Research (CERN), UNOSAT runs a Rapid Mapping Service to deliver satellite imagery and analysis where there is urgent need. After a natural disaster or other emergency, a UN entity, NGO, or Disaster Management Authority can contact UNOSAT and make a request for service activation. UNOSAT acquires necessary satellite imagery, either through a direct purchase from a commercial vendor or by having imagery supplied by a partner organization. UNOSAT then internally performs necessary processing or analysis before providing the end-user with a map, report, and/or GIS-compatible data layers to fit their needs. According to UNOSAT’s website, they manage on average 35 such requests per year (UNOSAT 2021).

Federally in the United States, the United States Agency for International Development (USAID)’s GeoCenter is actively involved in supporting international field missions, designing and monitoring field programs, and contributing to decision making within the agency related to development work. The GeoCenter has also partnered with Texas Tech University, Arizona State University, and the George Washington University to create the Mapping Resilience Consortium, which administers YouthMappers. YouthMappers is a network of college campuses that contribute to open mapping projects, often through student-run campus mapathons. Mapathons allow for crowd sourcing digitization efforts from satellite imagery to build out digital geospatial data infrastructure of under-mapped areas of the world. YouthMappers as an organization provides a bridge between students who volunteer to contribute data and global communities who would like their local city or neighborhood mapped. YouthMappers utilizes the underlying technology of Humanitarian Open Street Map.

Humanitarian Open Street Map was founded after the 2010 Haiti earthquake. Relief workers on the ground after the earthquake found that Haiti’s digital spatial data was lacking, with the digital street network composed of only main arterial roads. Volunteers from around the globe jumped in to help. Using OpenStreetMap and satellite imagery, volunteers were able to digitize buildings and roads, with Port-au-Prince's road network almost completely mapped just one day after the earthquake (Forrest 2010). A decade later, Humanitarian OpenStreetMap Team (HOT) has grown into an international organization changing disaster management practices and community development through open mapping. HOT’s website provides access to a Tasking Manger which allows volunteers with OpenStreetMap accounts to select crowd-sourced mapping tasks to contribute to. Edits go through a validation process before being added to OpenStreetMap.

4. Geospatial Technologies and Conflict

Geospatial technologies increasingly form a key pillar of modern-day warfare and play a key role in international affairs, allowing spatial information framework to support all aspects of defense infrastructure, from base and facility management, logistics, terrain analysis, mission planning, and visualization. GPS serves as a foundational tool used to aid navigation of military personnel and equipment around the world, and geospatial technologies are used to map and predict social unrest, track territorial control, guide precision-based weapons, and conduct drone strikes. Spatial analysis guides in the evaluation of terrain, evaluating viewsheds, and more (see also: Geospatial Intelligence and National Security).

Geospatial Intelligence (GEOINT) integrates all available geospatial resources, from traditional vector sources to satellite imagery to remotely collected measurements and information and puts these resources to work in an integrated resource designed to support defense and intelligence needs at the level of the nation-state. In the United States, GEOINT is controlled by the National Geospatial Intelligence Agency (NGA). NGA runs a GEOINT Professional Certification Program, with additional opportunities for professionals to obtain GEOINT certification offered by the US Geospatial Intelligence Foundation (USGIF) Certified GEOINT Professional program.

Internationally, bilateral and multilateral agreements have been forged across nation-states to facilitate the exchange of geographic information products. The Defense Geographic Information Working Group (DGIWG) was established in 1983 as a multi-national body addressing the need for the exchange of operational geospatial data and works to create international data standards. DGIWG's overall objective is to "provide strategic guidance and recommendations on the standardization of geospatial data, products, and services" while supporting the requirements of "NATO and the other alliances that members participate in, including UN sanctioned peacekeeping." DGIWG builds on top of standards created by ISO and the Open Geospatial Consortium (OGC). DGIWG has twenty-two participating member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, France, Germany, Greece, Italy, The Netherlands, New Zealand, Norway, Portugal, Romania, South Africa, Spain, Sweden, Turkey, the United Kingdom, and the United States.

Critiques of GIS based on its affiliation with the military-industrial complex trace back to the early 1990s, when GIS was argued to be an outgrowth of the quantitative in Geography, the objective of which was a search for universalizing truth or laws. In 1992, geographer Neil Smith penned "Real Wars, Theory Wars," an article which charged "GIS and related technologies" with contributing "to the killing fields of the Iraqi desert" (Smith, 1992). These charges have continued into the 21st century, with Derek Gregory's (2004) The Colonial Present making an arguing for the ways in which modern geospatial technologies can be used to erase the material reality happening to bodies and places on the ground. Geospatial technologies are increasingly being deployed in modern-day warfare. The on-going US involvement in the "War on Terror" provides multiple examples from which we can understand how these geospatial technologies can be used to erase the material reality happening to bodies and places on the ground. In his 2004 book The Colonial Present, Derek Gregory argues:

"Modern cartographic reason, including its electronic, mediatized extensions, relies on these high-level, disembodied abstractions to produce the illusion of an authorizing master-subject. It deploys both a discourse of objectivity – so that elevation secures the higher Truth – and a discourse of object-ness that reduces the world to a series of objects in a visual plane. Bombs then rain down on co-ordinates on a grid, letters on a map, on 34.518611N, 69.15222E, on K-A-B-U-L; but not on the city of Kabul, its buildings already devastated, its population already terrorized. Ground truth vanishes in the ultimate "God-trick," whose terrible vengeance depends on making its objects visible and its subjects invisible" (Gregory 2004).

Gregory has also detailed how geospatial technologies can advance or deny ways of looking through the control of satellite imagery. After heavy US-led bombing in Afghanistan as part of the "War on Terror," Gregory reports that the US National Imagery and Mapping Agency purchased all rights to commercial images of Afghanistan, thus prohibiting their use from news organizations. With a resolution "sufficient to identify bodies on the ground," the government was able to monopolize these civilian imageries to create spaces of "carefully constructed invisibility" and a "war without witnesses" (Gregory 2004).

Geospatial modes of viewing do not only affect fact-based or analytic decisions, they also hold the power to create emotions and change political decisions. Mei-Po Kwan (2002) has written about her own emotional reaction to viewing LIDAR images of the World Trade Center created after the September 11, 2001 terrorist attack. The LIDAR mapping technology was employed to show "the remains of the World Trade Center building structures and the craters the drop 30 feet below street-level at the site." Kwan demonstrates how viewing the LIDAR imagery, when combined with qualitative reporting and photographs of the events of that day played a role in capturing and preserving the trauma and power of the September 11th attacks and notes her own reaction as one of a "deep sense of grief" (2002). Maps and visualizations hold great power to help constitute the way we view and understand the world, what is possible for its future, and how we see our place in it.

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