

Article

An Open Source WebGIS Application for Civic Education on Peace and Conflict

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Abstract: By developing an interactive open source-based WebGIS information portal on war and peace for the online services of the Federal Agency for Civic Education, the Bonn International Center for Conversion (BICC) translates scientific knowledge into easily understandable and subsumable up-to-date information for the general public and young scholars. By aggregating globally scattered data and information on various peace- and conflict-related topics as well as presenting their spatial visualization through interactive maps, BICC contributes to a better understanding of peace and conflict processes. Users are invited to explore the relationship of various variables and their decisive roles in such processes.

Keywords: WebGIS; civic education; geo-visualization; war; conflict; peace; map; open source

1. Introduction

“Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information upon it” (Samuel Johnson, 18 April 1775) [1].

Wars, such as in the Ukraine, Syria, Iraq or Afghanistan, violent conflicts kindled by terror groups such as the so-called Islamic State in the Middle East or Boko Haram in Nigeria, or continuously increasing military expenditures and exports of military goods and weapons by powerful states—war and violent conflicts are widespread and reach ultimately into the capillaries of society. To understand conflict or peace processes, their possible interrelations and repercussions as well as to influence political and societal debates and decision-making processes, profound knowledge is needed. To foster “political efficacy in the formation and pursuit of citizen action and public policy, intended to move the world

toward the achievement of a more just and less violent global order” as phrased by Reardon [2], one matter is of special importance: easily accessible and, above all, reliable data and information.

Peace and violent conflict themselves, most of their inherent dynamics and far-reaching impacts but also many related interacting processes of social transformation and economic change have a strong spatial reference or leave spatial footprints. Thus data and information describing these processes and impacts are highly suitable for an interactive and geographic visualization. Against the backdrop of the given spatiality maps, particularly interactive maps, are not only an excellent way to visualize data and information in a comparative manner to a variety of different users, but even more so to stimulate learning and cognitive processes. Geographic visualization in particular, as explained by Dogde *et al.* [3], “works by providing graphical ideation to render place, a phenomenon or a process visible, enabling the most powerful human information—processing abilities—those of spatial cognition associated with the eye-brain vision system—to be directly brought to bear”. They continue by stating that “visualization is thus a cognitive process of learning through the active engagement with graphical signs that make up the display” [3]. All topics and subtopics of the modular information portal sicherheitspolitik.bpb.de combine interactive maps, dynamic and static information graphics, country portraits, data tables, a glossary as well as concise and easy to understand explanatory articles to increase the reader’s knowledge. The content presented mainly rests upon expertise and knowledge of the Bonn International Center for Conversion (BICC). Numerous researchers have been contributing articles and data to the various thematic modules. Until recently the portal was meant to serve as a knowledge transfer and educational tool for mainly German-speaking communities. However, an English version that will be launched in summer 2015 is currently being developed.

An earlier version of this paper, which served as the basis for this article, and discussed a previous version and basic functionalities of the open source WebGIS application, was published as a conference paper for the conference proceedings of the 3rd Open Source Geospatial Research and Education Symposium OGRS 2014 [4].

2. The Information Portal on Peace and Conflict

2.1. About the Motives to Develop a Peace and Conflict Information Portal

Peace and violent conflicts, their inherent dynamics and far-reaching impacts, but also many related processes, manifest themselves in many ways. Expressions of war or violence seem to be more visible than those leading to or sustaining peace. This might be because it is much easier to grasp the means of war and violence, such as the armory of states and non-state actors, the number of soldiers, military spending, *etc.* as well as the consequences of war and violence, such as the immense numbers of war deaths and victims of violence, the destruction of villages and cities, and just as war-induced refugee flows. Whereas politicians and scientist generally agree on certain definitions of violence and war (the main difference of which is the numbers of deaths defining thresholds for various types of conflicts) [5–7], defining peace seems to be more difficult. According to Megoran *et al.*, “a straightforward definition (of peace) is elusive and always contested” [8]. Neither is peace “simply an end product that is reached after war” (p. 252), “nor does it necessarily entail a just or benign society” [8]. Explanatory approaches vary from peace as a dynamic social construct to the notion of a future universal peace which exists in

the institutionalization of shared liberal norms—democracy, international cooperation and economic interdependence—the paths which can be pursued are multiple [9].

Detailed knowledge is critical for understanding the complexity of how and why violence and peace are intertwined and entangled [9]. Thus the overall aim of the information portal is to broaden the knowledge of the interested public and young scholars, and to increase their insights into complex political issues related to either peace or conflict. Political education, a generic name for civic education in Germany, is a general aim of education in Germany. Besides at school, it is also taught at most major socio-political and cultural institutions [10]. The Federal Agency for Civic Education (bpb), founded in 1952, which as a federal public authority provides citizenship education and information on political issues to all people in Germany, plays a particular role in that regard.

Peace education as part of political education, often linked to or understood as democracy education, typically focuses on the political processes associated with conflict. The underlying idea is that with an increase in democratic participation the likelihood of societies resolving conflict through violence and war decreases. Following James Page, peace education “may be thought of as encouraging a commitment to peace as a settled disposition and enhancing the confidence of the individual as an individual agent of peace; as informing the student on the consequences of war and social injustice; as informing the student on the value of peaceful and just social structures and working to uphold or develop such social structures; as encouraging the student to love the world and to imagine a peaceful future; and as caring for the student and encouraging the student to care for others” [11]. Teaching citizens/learners about the threats of violence makes them receptive of a sense of possibility that capacitates them to become agents of societal change [12,13].

Thus the portal is of particular importance in that it supports the overall educational mandate of the bpb. The portal enables different target groups to gain comprehensive knowledge through an extensive collection of well designed, easy-to-use maps and info graphics. Yet, the main motivation is to stimulate a deeper and more critical engagement with themes and multifaceted processes crucial for understanding the given context in the framework of civic education. Visitors are invited to actively acquire this new knowledge by employing the interactive components of the information portal.

In its 2001 renewed founding decree the bpb “is assigned to promote the understanding of political issues, strengthen awareness for democracy and willingness to participate in political processes amongst all citizens through civic education” [14]. One of its key activities is the provision of information about the major issues of our times. Knowledge of how war or peace “function”, of how they become visible, leave their impacts and influence the everyday lives of people around the globe as well as awareness of underlying political and societal processes are important components of civic education [10,15,16]. To fulfill its mission, the multimedia editorial department of bpb has broadened its output in recent years by intensifying the use of modern media tools and visuals. Info graphics as well as interactive solutions for specific questions or topics of political interest have been developed and are provided to the public for download on bpb’s website. The Bonn International Center for Conversion (BICC) on the other hand, guided by its vision to contribute to a more peaceful world [17], has been conducting applied research on different themes and topics of peace and conflict for 20 years. BICC is likewise obliged by its shareholders to make its research outcomes available to the general public by various means.

Against this background both institutions started planning and implementing the information portal on peace and conflict with a WebGIS-based mapping component as its central data visualization feature

five years ago. The information portal as one element of this multimedia approach differs significantly from the previous media tools for two reasons. First, it is developed and edited by peace and conflict researchers at BICC. Second, it does not only visualize data, but rather promotes the process of gaining knowledge—a key concept of civic education—by offering a set of various knowledge carriers on many interconnected variables necessary to understand specific peace and conflict processes. Both maps and info graphics have proven to be excellent tools to facilitate the understanding of complex relationships [2,18] The cooperation has created a win-win situation for both institutions: While the bpb has received a modern, interactive geo-information portal with the latest peace and conflict data and information available supporting its mission to inform the public, BICC has been able to present its knowledge and research findings to a wider general public having gained access to the large user group of bpb's website.

This initial phase was devoted to developing and testing a portal structure which best fits the given requirements. In this context the design and the structural composition of the portal, the orientation and organization of its content and update procedures were substantially tested. By the end of this phase, the portal was successfully evaluated by external peace education and web development experts. In 2014, after four years of cooperation, both institutions agreed to maintain, constantly update, and further develop the portal. The renewed long-term cooperation includes a re-design of the entire portal, the development of another module and additional content to existing modules, the improvement of information accessibility and, last but not least, an English version of the portal.

2.2. Civic Education

In recent years, the widespread distrust in governments and governmental institutions and, associated therewith, the declining participation of citizens in democracies have increased the need of active citizens who critically engage with and seek to affect the course of social change, empowered by educational processes that provide intellectual skills and knowledge to stimulate and facilitate such active participation [10,16]. High quality civic education is seen as a significant response “to the problem of how to promote such participation in diverse, pluralistic societies” [10] and a means of building and strengthening viable systems of governance in the long term [16]. Due to contrasting cultural and political traditions as well as different educational approaches and systems there is no common understanding of civic education. Thus, there are various understandings and diverse approaches to educating citizens across the globe. Citizenship itself is a contested concept; criteria to define citizenship span from emphasizing citizens' rights to the duties of a citizen, refer to the legal status of society members or their identity and possession of values [10,16,19]. Still, even though the understanding of citizenship and civic education varies from country to country, there is one thing that all have in common: they all recognize the significance of civic education.

Civic education or citizenship education as Ross put it “deals with the relationship between the individual and political society, between the self and others” [20]. To achieve the necessary level of civic competency, as coined by Chow [21], three elements have to be part of any civic educational program and thus are also crucial when developing any educational application: “values and dispositions, skills and competency, and knowledge and understanding” [15,20,22–24]. The portal presented here addresses all three elements, although its focus lies on the provision of knowledge and understanding. The user is

expected to actively engage with the tool to exploit data and information on various aspects of peace and war as well as related socio-political processes. By providing more than just basic data and information, particularly through “information visualization” (InfoViz) and “geo-visualization” (GeoViz), the portal stimulates the conceptual understanding of underlying key processes and facilitates opinion-forming processes of learners. In consequence, the conceptual design of the portal follows scientific insights of information science, and transfers findings and concepts gained through InfoViz and GeoViz to ensure that it is highly appropriate for its civic educational purpose [25,26].

2.3. The Relevance of Information Visualization and Geographic Information Applications for Civic Education

Multimedia technologies and applications play an important and constantly increasing role in all fields of education and training. Effectively deployed they are an important component of how social, political, and economic processes are negotiated by individuals or institutions [27]. As previously laid out, such technologies have to fit various purposes and have to meet the most demanding requirements. Not only does today’s technology have to provide data and information to the user/learner but it also, and even more so, has to provide knowledge. Thanks to the availability of digital technologies, maps—already in pre-digital times ubiquitous—have undergone a major shift [28]. Modern geographic mapping and geo-visualization systems “provide the means of publishing information-rich geographical information products, from which knowledge can be gleaned from a generous delivery mechanism” [29] (p.336). The implemented knowledge carriers (maps, infographics, *etc.*) of the information portal reflect a combination of what Cartwright calls “access metaphors” [29]. To the traditional map metaphor for the representation of geographic information Cartwright adds a set of nine additional metaphors “which are intended to be used in conjunction with maps” [29]. According to Cartwright, these access metaphors enable products such as information portals “to aid in imparting knowledge in ways that the user feels more comfortable with, and thus transfer information more effectively [29].” On the one hand, the “guide metaphor” [29] for instance allows the user to better appreciate and understand the information presented. By focusing on pertinent datasets, the user is guided to the most important information needed in the given context. On the other hand, the “data store metaphor” [29] enables the user to access additional information about a specific topic of interest, without having to display all of the related or enclosed data and information. Through several incorporated interrogating control elements, such as layer overlays, the user of the portal is able to seek complementary information, which is immediately displayed (map metaphor). Also of relevance for the application presented in this paper is the “fact book metaphor” [29], which provides the means to access a vast quantity of facts about a specific area of interest, and which simultaneously offers the opportunity to compare data and information of other related topics.

Applications of online geospatial technologies and spatial data are conceptually described and captured by the term “Geospatial Web” or “Geoweb” [27,30]. These technologies allow for new forms of knowledge-sharing and learning and are therefore particularly suitable for the development of civic education applications. As stated by Papadimitriou “the most important new property of the “Geospatial Web” is the potential to introduce, upload, process, update and digitally manipulate a broad range of geographical and related data” [30]. These positive features significantly benefit the transfer and distribution of information and knowledge, many of them aiming at analyzing and visualizing spatial

information and data which reveals previously hidden relationships, patterns, and trends [27,30–32]. Of particular importance in that regard are the increasing number of open source (GIS) software and the adaptability of free mapping application programming interfaces (APIs) [27,30,33,34].

Maintained information portals, as the one presented here, or similar online applications facilitate the possibility to improve people's capacities to actively engage in the global information society and provide means for lifelong learning. In times and "in a world in which "to google" has become a verb almost synonymous with "to learn" [35], people and institutions involved in civic education can fortunately built upon the learner's basic knowledge and understanding of how to access and use digitally presented information.

InfoViz plays a crucial role in civic and in peace education, as its main function is to gain an understanding of the underlying data and phenomena by utilizing computer graphics and interaction [26,36]. According to Purchase *et al.*, gaining understanding in this context may be thought of as constructing a concept, or mental model, of the data or phenomenon presented. "The model in turn can be understood as a parsimonious representation capturing essential features of the data rather than listing all individual data items" [36]. InfoViz tools allow the user to perceive patterns that could be used to build an appropriate model of the examined phenomenon. It still remains an "inductive method in the sense that it is meant at generating new insights and ideas that are the seeds of theories, but it does it by using human perception as a very fast filter: if vision perceives some pattern, there might be a pattern in the data that reveals a structure" [26].

InfoViz as well as GeoViz as insight-generating methods are gaining in importance both in science and education [26,36], particularly for their key strength to accelerate the process of filtering and digesting collected data/phenomena, *i.e.*, their meanings [32]. InfoViz and GeoViz build upon information theory, according to which vision is the sense that has the largest bandwidth: 100/Mb/s. Hence "the visual channel is the best suited to carrying information to the brain" [26]. Following the cognitive theory of multimedia learning [25], multimedia instructional messages, *e.g.*, maps and infographics, delivered by various media, including the computer (*i.e.*, computer-based communications) intend to foster learning. Thus, InfoViz can be viewed as the communication channel from the dataset to the cognitive processing unit of the human observer [36], which enfolds its full potential when presented in an interactive manner [26].

For the information portal presented here, this means that the user is stimulated to recognize relationships between various peace- and conflict-related indicators, such as the availability and distribution of certain natural resources, the economic dependence on such resources and the existence of violent conflicts. Through the mediation by InfoViz/GeoViz tools (WebGIS interfaces, mapping APIs, infographics, *etc.*) various phenomena are translated into more easily digestible information [32,37]. The possibility to superimpose several visual elements (map layers, *i.e.*, translated phenomena) helps the users to find parts of the data as well as patterns that are worth a more careful study. The interactive nature facilitates the investigation of the previously hidden patterns and relationships of different phenomena.

2.4. Open Knowledge Benefits from Open Source

The geographic visualization approach followed for the implementation of this portal can be characterized as the "querying" type, one of the three epistemological classes which have been introduced by Dodge *et al.* [3]. This approach builds on database techniques and enables "users to

navigate through complex information spaces” [2]. To meet the objectives of the portal and to ensure both a high level of flexibility and a high durability at the same time, the decision was made to implement the portal by using Free and Open Source software. The underlying principles of open and free software, (1) the freedom to run the software for any purpose (e.g., may it be education or business), (2) the freedom to study and adapt the software for own needs, (3) the freedom to redistribute the software, and (4) the freedom to improve the software and to release improvements to the public [38], are in accordance with the mandates and visions of the two implementing institutions. Moreover, according to Steiniger and Hunter, popular open source software attracts “a strong following of users and developers” [39] and receives support, free of charge, from those user and developer communities. These principles not only enable, but more so ensure, a long-term development and modification of the project software infrastructure at low costs. The strong commitment of open source geospatial software to industry standards, such as those developed by the Open Geospatial Consortium (OGC) [40], increases the sustainability of the underlying technology and provides the flexibility and opportunity for adaptation and adherence to technical specifications and data formats at the same time. This is an important aspect for such an application which, in a way, is a living application constantly subject to change in terms of content and functionality.

PostgreSQL [41] with the PostGIS [42] extension has been used as the underlying database for the application, (UMN) MapServer [43] as geo-server, OpenLayers [44] as mapping client and main user interface as well as MapProxy [45] as map proxy for the WebGIS infrastructure. A brief sketch of the functional relationship is given in Figure 1.

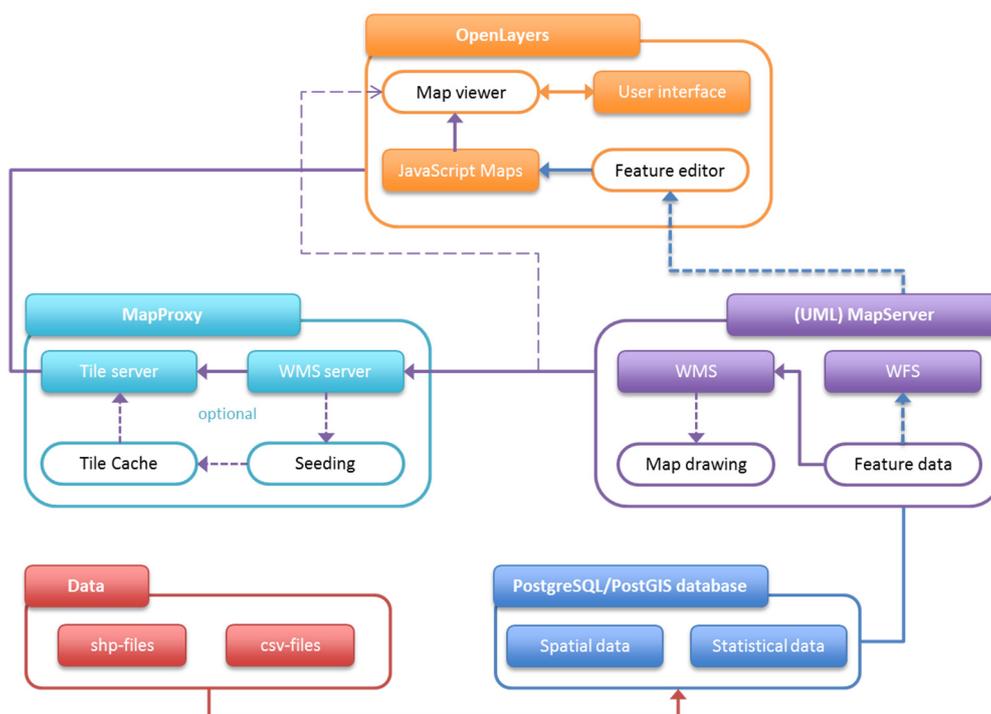


Figure 1. Applications Architecture of the spatial components.

The content has been embedded in CMS Made Simple [46] as content management system (CMS). Dynamic info graphics are created with pChart [47], a PHP charting library.

The selection and use of the aforementioned software was and still is bound to certain requirements: All components have to be stable, have to have a good documentation, a stable developer community,

and preferably also a large supportive user community. Moreover all open source components had to prove their compatibility with and the potential to be used, manipulated and tweaked easily towards the technical and functional requirements.

Most of the open source geospatial components have a long history in the open source community and have widely proven their applicability: PostgreSQL (since 1995) in tandem with PostGIS (since 2001) as the dominant and most powerful open source spatial database system [48,49]; MapServer (since 1995) as the perhaps “most popular geo-server which contains a lot of functionality and can run under practically any web server without requiring installation” [50]; OpenLayers (since 2006), a JavaScript library, as one of the most flexible, powerful but easy to use thin web mapping clients [51,52]; MapProxy (since 2010) as an accelerating web map proxy with tile server and full compliant WMS server capabilities.

2.5. Applications Architecture

As shown in Figure 1 the PostgreSQL/PostGIS spatial data base management system serves as a backbone to the application which stores and provides all statistical and geo data needed to create and display the thematic map layers, corresponding data tables and info graphics. PostgreSQL/PostGIS come along with all necessary spatial data types and functions needed to query, spatially analyze, store and update all relevant data. Supplied with spatial data, stored in the applications database, (UMN) MapServer creates and provides upon request one or more georeferenced rasterized maps in common formats such as jpg or tiff—generally to the map client. In a nutshell it’s the server that provides access to spatial data through a set of standardized mapping services. The application builds upon OGC standards and provides Web Mapping Services (WMS) [53], Web Feature Services (WFS) [54], or Web Coverage Services (WCS) [55]. For each map layer, the appearance is defined in different map-files. MapServer is also capable of handling client-side predefined styles as part of the WMS requests, which return maps in a user-defined style [39]. Geospatial features are dealt with by the WFS, which allow for the manipulation of such features. OpenLayers enables the users to interact with the map on the website. On the one hand, it functions as a map client to display the map-layers provided by MapServer in a web browser. Of the many visualization and manipulation functions only the basic ones are used for the information portal. The user can zoom in/out, pan the map, and create an individual view of the map. MapProxy accelerates the speed of the interactive maps. Most of the georeferenced rasterized maps files, generated and usually provided by MapServer to the map client are requested on a regular basis. As these pictures don’t change that often there is no real need to recreate them with every map request. MapProxy calculates these pictures in advance and stores them systematically in its tile cache. After the calculation these cached picture files replace the map creation from MapServer. CMSmadesimple is a PHP written CMS that provides a simple and easy to use framework for the geo data infrastructure and a user interface to administer, edit and store all static information.

As concerns the spreading of knowledge and civic education in accordance with the mandates and missions of bpb and BICC the application is licensed under Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported (CC BY-NC-ND 3.0) [56]. The first version of the license was published in 2002, and version 3.0 has been available since 2007. Thus all visuals and articles can be copied and redistributed, under the condition that an appropriate credit is provided, a non-commercial

use is ensured and the material is not manipulated. Such a creative commons license not only supports, but even ensures the spread of information on peace and conflict.

3. Components and Functions of the Information Portal

3.1. Portal Structure, Components, Content Types and Functional Relations

The development of the WebGIS-based information portal which provides essential knowledge and data on peace and conflict started in 2010 with the launch of the first thematic module on military capacities. Seven out of eight planned thematic modules have been successively developed over the past years—all together covering the important aspects of peace and conflict. Each new module, presenting a specific theme, which was integrated into the portal added new content and perspectives to the broad theme of peace and conflict. This module-by-module approach constantly increased the users' benefits and, as the portal became more complete, recurrently attracted new user groups. The general structure and the main content types over which bpb and BICC had come to an agreement, is shown in Figure 2.

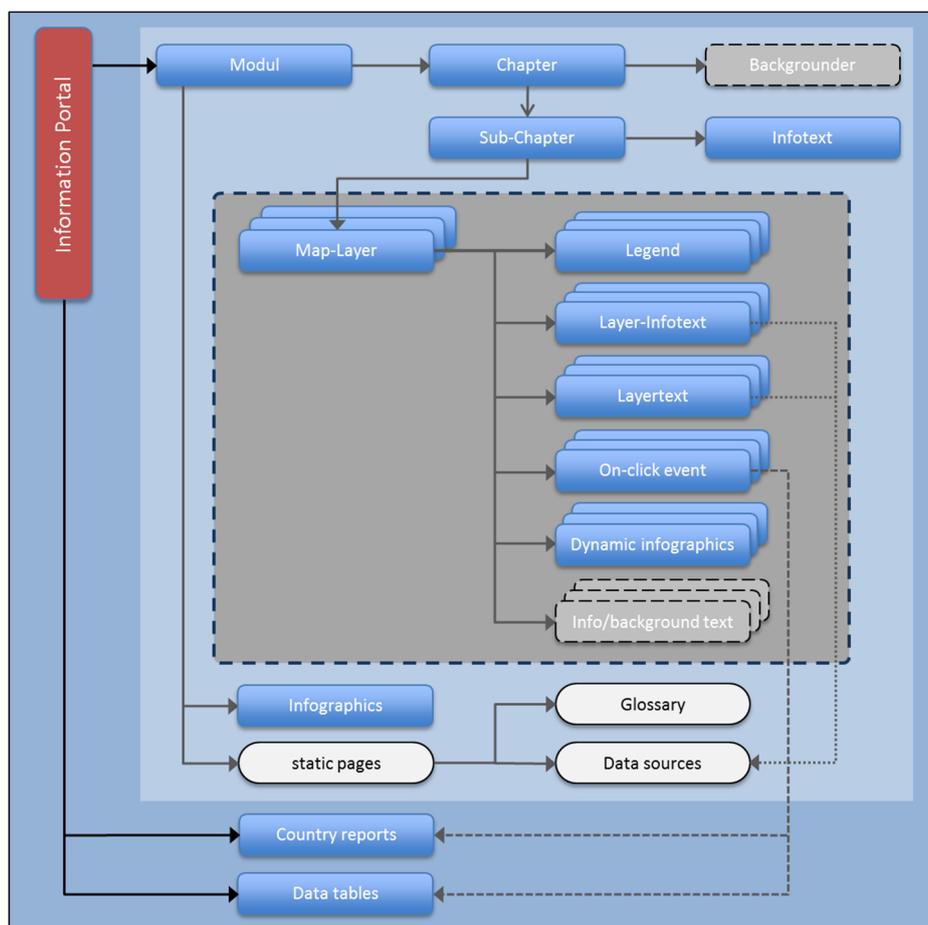


Figure 2. Portal structure, main content types and their relations.

Figure 3 pictures an example of how the application has been implemented. Centerpiece of the portal is the mapping component that is user-operated by the layer-switcher (Figure 3, (1)). To meet the overall coordinated concept the layer switcher was developed as the control center for the geo-visualization of all data stored in the central database. Not only does it function as an intuitive-to-use layer selection menu

through which thematic maps are displayed, it also initiates the provision of single layer corresponding information below the mapping component (see Figure 2 and Figure 3, (2)). In total a maximum of three layers (polygon, hatch and point layer) can be selected simultaneously. For each layer (Figure 3, (3)) selected, additional corresponding content, such as in-depth articles and explanatory info graphics, are provided below the map—if available and foreseen (Figure 2 and Figure 3, (2)). To prevent nonsense map overlays only various predefined meaningful layer combinations, involving one or more modules, are possible. Should information from another than the selected module be desired as a further source for overlaying, the layer-switcher expands itself and offers all possibly selectable layers to the user.

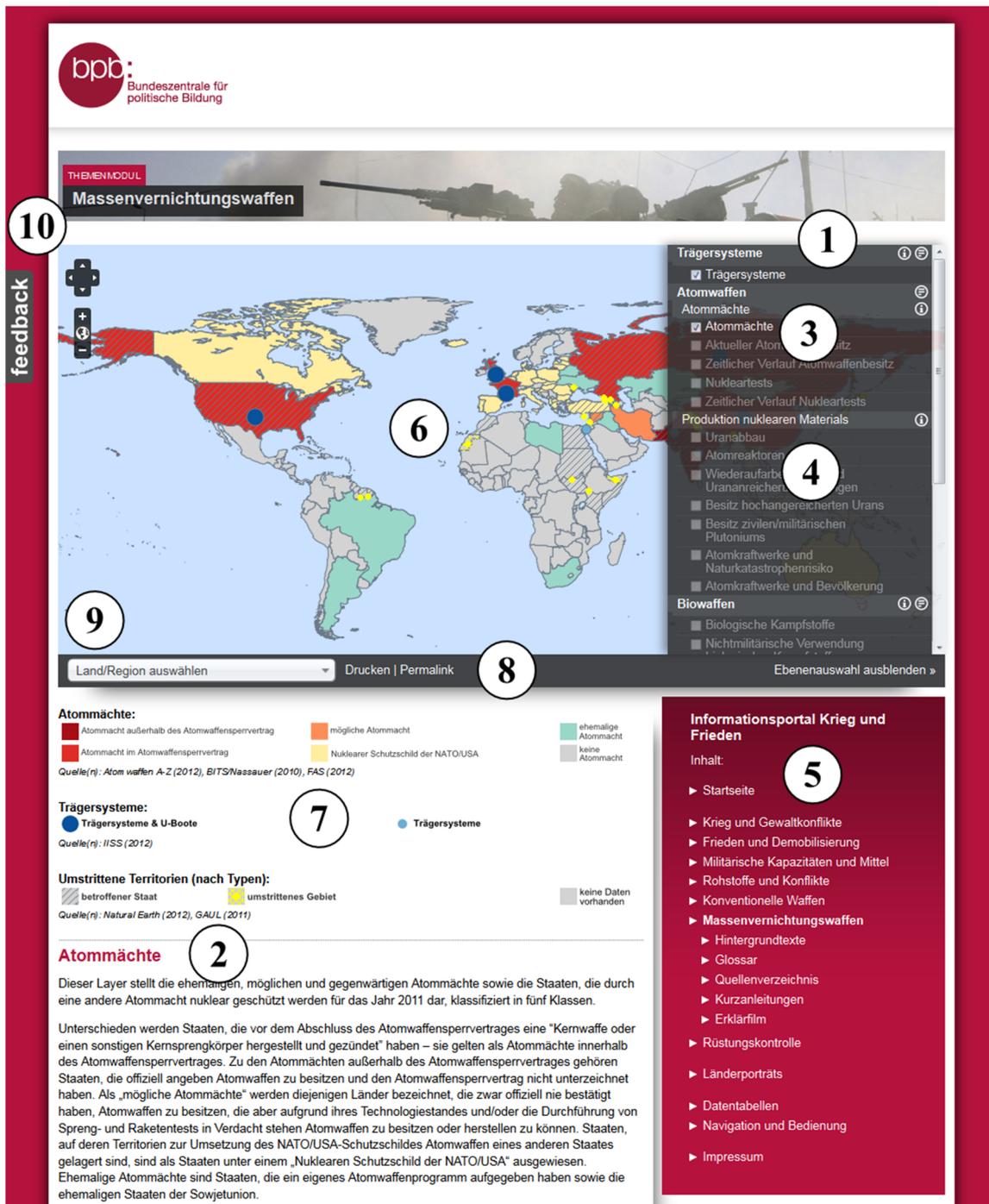


Figure 3. Screenshot—Thematic module weapons of mass destruction.

When selecting a layer, the user can only select those that are predefined as compatible; all other layers are greyed out (Figure 3, (4)). The predefinition of the layer combinations for individual modules and between modules is content-driven and solely based on the expertise of the involved peace and conflict researchers at BICC. Standard layer selection features offered by OpenLayers were not suited to meet the requirements. Yet, this was not the only reason why finding a technical solution has been a challenge. The number of potential combinations increases with each new module. In consequence all combinations have to be checked and, if necessary, adapted. In principle, new combinations lead to changes in the visualization characteristics of certain layers in certain thematic modules—whether datasets have to be displayed as polygon, hatch or point layer. In some cases, this can lead to a different appearance of certain layers depending on whether they serve as base or overlay layers in one specific or in several modules.

3.2. Interaction with the User

The user can access information in two ways: One, most importantly, via the thematic modules. This path follows and tries to serve a comparative country approach at the global and regional scale. The user has to choose a module on the landing page below the introductory text or from the main menu on the right hand side (Figure 3, (5)). The interactive mapping client (Figure 3, (6)) with the layer-switcher as the control unit on the right (Figure 3, (1)), is only accessible through the module pages. Once one or more layer(s) are selected, corresponding legends (Figure 3, (7)) and explanatory notes and info graphics as well as teasers relating to additional in-depth articles and articles are offered immediately underneath the map (Figure 3, (2)).

Short explanations on what is being shown on the map, how it should be read, and which sources have been used, appear when the user clicks on the layer names in the layer selection menu. The layer tree also offers short definitions of what is being addressed by the respective layers under each subheading of a thematic module. This information can be accessed through a click on the info icon right next to the subheading.

Besides typical map client functions—zoom and pan—a permalink and print function (Figure 3, (6)) as well as a zoom to the country drop-down menu (Figure 3, (9)) have been added. A single or a combination of layers with a specific view can be sent to another user via a permalink; this feature makes sure that discussions, for example in the classroom, are based on the same map. With regard to information access the on-click events must be mentioned. An information pop-up window opens when the user clicks on a country on the map. Here country specific data and information of the selected layers is given as well a link to a comprehensive country data portrait. In the standard, global view (zoom to full extent), many points of various point layers may—due to the size of the points—overlay others. This is deliberate because it motivates the users to zoom in and to interact with the map.

As a second option besides the content-driven, spatial-comparative access through the selection of a thematic module and global map layers, a single country-related access path was put in place. The choice a country either from an alphabetical list in the country portrait menu or from a corresponding link in the On-Click information pop-ups in the map triggers a country data portrait. Every portrait consists of two parts: Basic information (e.g., size, population, *etc.*) including a plain map with its neighboring

countries introduces the selected country. Below the map, all data used for the layers in one or all modules are presented in a table-style country profile as shown in Figure 4.

Länderporträts

[Zurück zur Länderauswahl](#) | [Ländervergleich](#)

Syrien 

Anerkennungsstatus:	anerkannt
Staatsform:	Republik
Regierungssystem:	Einparteiensystem
Einwohnerzahl:	20.820.311
Fläche:	187.318 km ²
Hauptstadt:	Damaskus



The map shows Syria in the center, shaded in grey. Surrounding countries are labeled: Türkei (Turkey) to the north, Libanon (Lebanon) to the west, Irak (Iraq) to the east, and Jordanien (Jordan) to the south. The Mediterranean Sea is visible to the west, and Zypern (Cyprus) is shown in the sea. The borders of Syria are clearly marked.

Kriege und Gewaltkonflikte

Land	Syrien
Konflikt-/Kriegstyp (2013)	innerstaatlich
Anzahl Kriegsopfer pro 100.000 Einwohner (2013)	--
Anzahl der gewalttätigen Konflikte und Kriege zw. 1946-2013	6
Opfer sexueller Gewalt in Kriegen nach 1946	--
Anzahl Morde pro 100.000 Einwohner (2010)	2,20
Anzahl Raubüberfälle pro 100.000 Einwohner (2008)	4,30

Figure 4. Screenshot—Country portrait of Syria.

This general country portrait function (Figure 4) has currently been developed further. Not only can the information and data now be presented for one country it can also be compared with up to two additional countries, as presented in Figure 5. This can be an advantage if, for instance, the user is interested in a specific conflict in which several countries are involved.

All users are invited to give direct feedback—general questions, technical problems and/or suggestions and criticism—to BICC via the feedback button (Figure 3, (10)) on the left of the portals site. This feedback function is very important as user feedback given, besides reports on smaller errors, may trigger content discussion and thus gives room for constant improvement both with regard to

functionality and to content. Some positive feedback has shown the portal's multifaceted applicability for teaching purposes in classrooms.



Figure 5. Screenshot—Country comparison function 4. Content Addressed by the Information Portal.

By aggregating globally scattered data and information on various peace- and conflict-related topics and by presenting their spatial visualization through interactive maps, the portal offers an unique approach to collecting and using data for civic education. The project aims at using as much well-founded and open data sources as possible.

More than 120 different global datasets and indicators on specific aspects of conflict and peace-related topics—most of them publically available—have been searched and collected from more than 90 different well-known official sources such as the World Bank, the International Monetary Fund, Food and Agriculture Organization (FAO), various UN organizations (e.g., UN DPKO, UNODC, UNDP) as well as from a number of peace and conflict research institutions (e.g., BICC, SIPRI, PRIO)—just to name a few.

The same applies to the geo data that mainly originate from open sources such as Natural Earth [57], CShapes [58] and the FAO [59] GAUL dataset. Natural Earth, featuring integrated vector and raster data,

is a map dataset available in three different map scales: 1:10 million, 1:50 million and 1:110 million. CShapes a dataset provided in a geographic data format (shp-file format), offers historical maps of state boundaries for the post-World War II period [58]. Natural Earth data have been used for the global base map, whereas CShapes provides historic country boundary vector data for the layers that visualize certain data in a temporal manner. The GAUL dataset and the Natural Earth data are being used to identify disputed territories.

Statistical data have been manipulated, arranged in categories and classified according to certain features and types of information. The datasets have been stored systematically in the spatial project database. Where necessary, spatial data have been prepared and manipulated either directly by PostGIS functions or by tools such as the desktop GIS software QGIS [60]. The spatial data are stored in the applications PostgreSQL database. All statistical datasets are updated on a regular bi-annual to annual basis, and the spatial datasets with the current and historic country borders are updated whenever required. The background information includes a full metadata set with source, description, unit, indications and, if possible, a table with raw data.

Violent conflicts, more so than peace processes, are unfortunately a normal and more visible part of our everyday lives. Violence has many faces and facets, with war between groups or nations as the extreme manifestation of conflict. The number of influences on the faces and facets of conflict is uncountable, but the information portal provides an overview of important global indicators and relevant intervening socio-political and socio-economic parameters. These data help the learner to recognize and better understand the complexity of how and why violence and peace are intertwined and entangled. Like violent conflict, peace “looks different in different places at different scales. Because places are distinct, so are ideas and practices of peace”, ..., (they) “change as they move location through both space and time” [8]. The portal tries to reflect this through its interactive and modular structure. To adequately address the topic of peace, we have dedicated one module to peace and to the demobilization as a peace—oriented process in post—conflict situations. Another module provides data and information on various processes related to the control of arms and disarmament.

One practical example (Figure 6.): This portal provides someone who is seeking information about chemical weapons and other weapons of mass destruction is provided with data and information which goes beyond what is presented in the daily press. The module on Weapons of mass destruction provides an overview of carrier systems, nuclear weapons, the production of nuclear material, and also biological and chemical weapons. A user wishing to find out which states possess chemical warfare agents selects the corresponding layer in the layer selection tree. This results in a global map indicating which states possess these weapons, where possession is possible or unlikely, which states are clean and for which no data is available. This information can be now combined with additional data from other modules; layers, such as the one of “current conflicts” or the one showing the “level of militarization” can be superimposed to the “chemical warfare agents” layer. Explanatory articles and links to further sources of information are provided below the map.

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THEMENMODUL
Massenvernichtungswaffen

Land/Region auswählen | Drucken | Permalink | Ebenenauswahl ausblenden »

Chemische Kampfstoffe:
 ■ Besitz bekannt ■ Besitz möglich ■ ehemaliges Chemiewaffenprogramm (ggf. Restbestände) ■ kein Besitz ■ keine Daten vorhanden
 Quelle(n): CNS (2008)

Kriege und Gewaltkonflikte (nach Typen): Quelle(n): UCDP (2014), FRIIO (2014)
 ■ internationalisiert innerstaatlich ■ innerstaatlich ■ zwischenstaatlich ■ ausserstaatlich

Chemische Kampfstoffe
 Dieser Kartenlayer stellt den in vier Klassen eingeteilten Besitz von chemischen Kampfstoffen für das Jahr 2008 dar.
 Genaue Angaben über den Chemiewaffenbesitz einzelner Staaten sind schwer zu machen, da viele Chemiewaffenprogramme geheim sind und/oder waren und es keine unabhängige Beurteilung oder zugänglichen offiziellen Datenbanken gibt. Für die Darstellung in der Karte wurden die Länder vier Klassen zugeordnet: Besitz bekannt, Besitz möglich, Besitz unwahrscheinlich und kein Besitz.
 Länder, bei denen der Besitz von Chemiewaffen entweder offiziell deklariert wurde oder für den es eindeutige Belege gibt, wurden der Kategorie 'Besitz bekannt' zugeordnet. Alle Staaten, die 2008 ein Chemiewaffenprogramm oder ein Chemiewaffenforschungsprogramm betrieben haben und die nach Angaben von Regierungs- oder Militärangehörigen oder externen Experten möglicherweise Chemiewaffen besaßen, wurden in der Kategorie 'Besitz möglich' zusammenfasst. Länder, die ein ehemaliges Chemiewaffenprogramm betrieben haben und zum Zeitpunkt der Veröffentlichung kein Forschungsinteresse besaßen, wurden der Kategorie 'Besitz unwahrscheinlich' zugeordnet. Alle anderen Länder wurden der Kategorie 'kein Besitz' zugeteilt.
 Quelle: CNS 2008

Informationsportal Krieg und Frieden
 Inhalt:
 ▶ Startseite
 ▶ Krieg und Gewaltkonflikte
 ▶ Frieden und Demobilisierung
 ▶ Militärische Kapazitäten und Mittel
 ▶ Rohstoffe und Konflikte
 ▶ Konventionelle Waffen
 ▶ Massenvernichtungswaffen
 ▶ Hintergrundtexte
 ▶ Glossar
 ▶ Quellenverzeichnis
 ▶ Anleitungen
 ▶ Erklärfilm
 ▶ Rüstungskontrolle
 ▶ Länderporträts
 ▶ Datentabellen
 ▶ Navigation und Bedienung
 ▶ Impressum

Figure 6. Screenshot—Example chemical warfare agents.

The overall content structure of the information portal and its breakdown into eight different thematic modules is loosely based on the chapters of the fundamental peace research textbook “Handbuch Frieden” by Gießmann and Rinke [61] that is often used for peace training at universities. So far, seven modules (Figure 3, (1)) and their sub-chapters have been developed and implemented:

- War and conflict
 - Violence, conflicts and war
 - Causes of violent conflicts
- Peace and demobilization
 - Peace and peace missions
 - Disarmament, demobilization and reintegration
- Military capacities
 - Military resources
 - Militarization
 - Arms trade
- Resources and conflict
 - Mineral resources and distribution of mineral resources
 - Resource conflicts
 - Resource control regimes
- Conventional weapons
 - Conventional weapons
 - Small and light weapons
 - Landmines and cluster munition
- Weapons of mass destruction
 - Launcher systems
 - Nuclear weapons
 - Biological weapons
 - Chemical weapons
- Arms control
 - History
 - Conventional weapons
 - NBC weapons
 - Space weapons

An additional module on Environmental security will be completed in the second half of 2015.

Currently the information portal comprises 112 thematic maps, many of which can be superimposed, 80 info graphics, 19 data tables, 71 focus articles, 22 background articles, and seven module glossaries explaining more than 210 terms. All content is edited in plain and intelligible language to meet the different skills of the various target groups: interested members of the public, researchers, teachers and learners, policymakers, and representatives of the media.

4. Concluding Remarks

The portal, presented here as an Open Source GIS application use case in the realm of civic and peace education, has proven its concept. The application is frequently used by learners and interested citizens and thus fulfills what bpb and BICC have aimed at—providing an open tool for civic education.

Still, the portal is a living application which needs constant maintenance of content and functionality. Ergonomics and user-friendliness can always be improved. Hardware and software are constantly

changing. Therefore enhancements of the used software must be permanently monitored and tested against new products. This is why there is always the risk, but also the possibility of having to rework and redesign the running system and to a change certain components. In this regard BICC is currently developing additional tools for the analysis, visualization and export of data and information. Screencasts, explaining the individual modules are being produced and will be integrated soon.

Both partners BICC and bpb are intend on increasing the user community of the portal. The information portal, initially developed for the German educational market only, has demonstrated its worth. Stimulated by international requests, the decision has been taken to develop an English version of the portal. The implementation will follow the same approach adopted in the German version. A launch with three to four modules is envisaged for this summer, with the remaining four modules to be added in 2016.

To facilitate the study of the complex relationship between violence and peace that manifests itself every day, it is necessary to educate learners to become agents for change to a more peaceful world. The critical reflection of expressions of violence always implies a reflection of opportunities for peace.

With this work we hope to enthrall and motivate other research groups of other disciplines to follow in our footsteps to provide attractive and intuitive scientific knowledge for education purposes. Open source-based geo-information portals have proven to be an appropriate means strengthening the connection between scientific research and education practices.

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Conflicts of Interest

The author declares no conflict of interest.

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