http://aca083.pstud0.mt.haw-hamburg.de/

World War 2 Navigator

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Exposé

The intent of this project was to develop an application to present the most relevant and decisive events of the second world war. Furthermore, it served as an exercise on database to web visualization. To achieve this, we chose to create a dynamic world map, utilizing a variety of web development tools at our disposal, such as HTML, CSS, PHP, JavaScript and a SQL database. This allowed us to find the best compromise between educational value and technical finesse.

The user interaction consists of a navigation bar, clickable icons and a slider at the bottom of the screen. The navigation bar features different tabs, each containing information about the website itself or further information on the participants of World War Two. The slider allows users to navigate between the years of 1939 and 1945, while the icons provide information on specific events, battles and units, as well as displaying geographical correlations.

Idea and Motivation

The idea for the project is based on a general interest in maps, historical or fictional, as well as a genuine passion for history and strategy, specifically those of World War Two.

Therein lies the desire to create an application featuring the history of the Second World War, possibly inspiring the reader to find out more and raise awareness about the importance and value of the topic.

Mockup Frontend

Following the project pitch the idea and general layout had to be merged into a viable presentation of the data available. As such, multiple images served as inspiration for layout and data presentation.

Figure 1. *Marine Traffic Map* **[Infographic].**

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Figure 2. *Political world map* [Infographic].

Many sources influenced the development and creation of the first few drafts. Such as the style of the map, i.e. vector graphic, painting, etc.

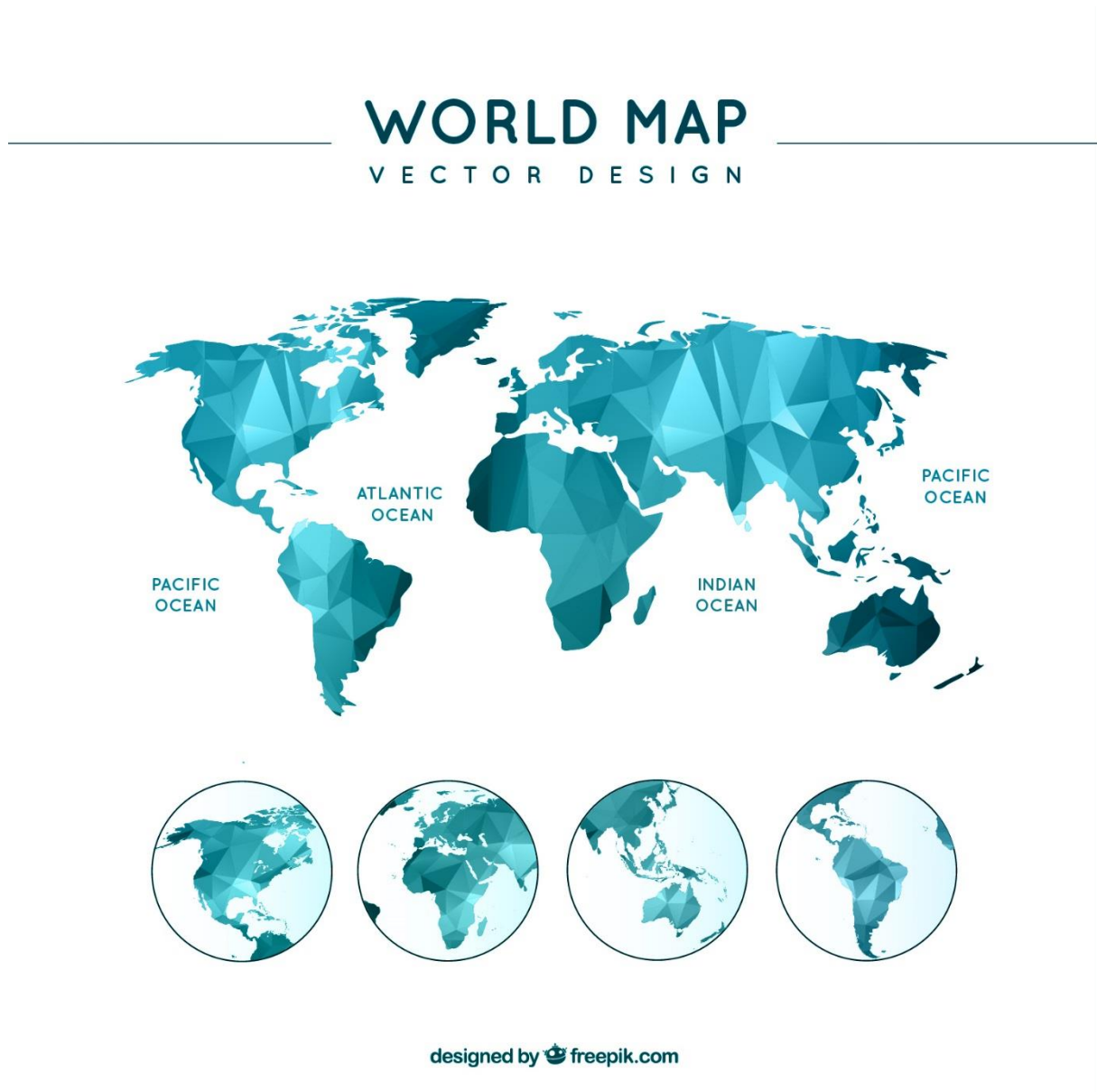**Figure 3.** *Vector Graphic of Europe* [Illustration].

Figure 4. World map vector design [Illustration].
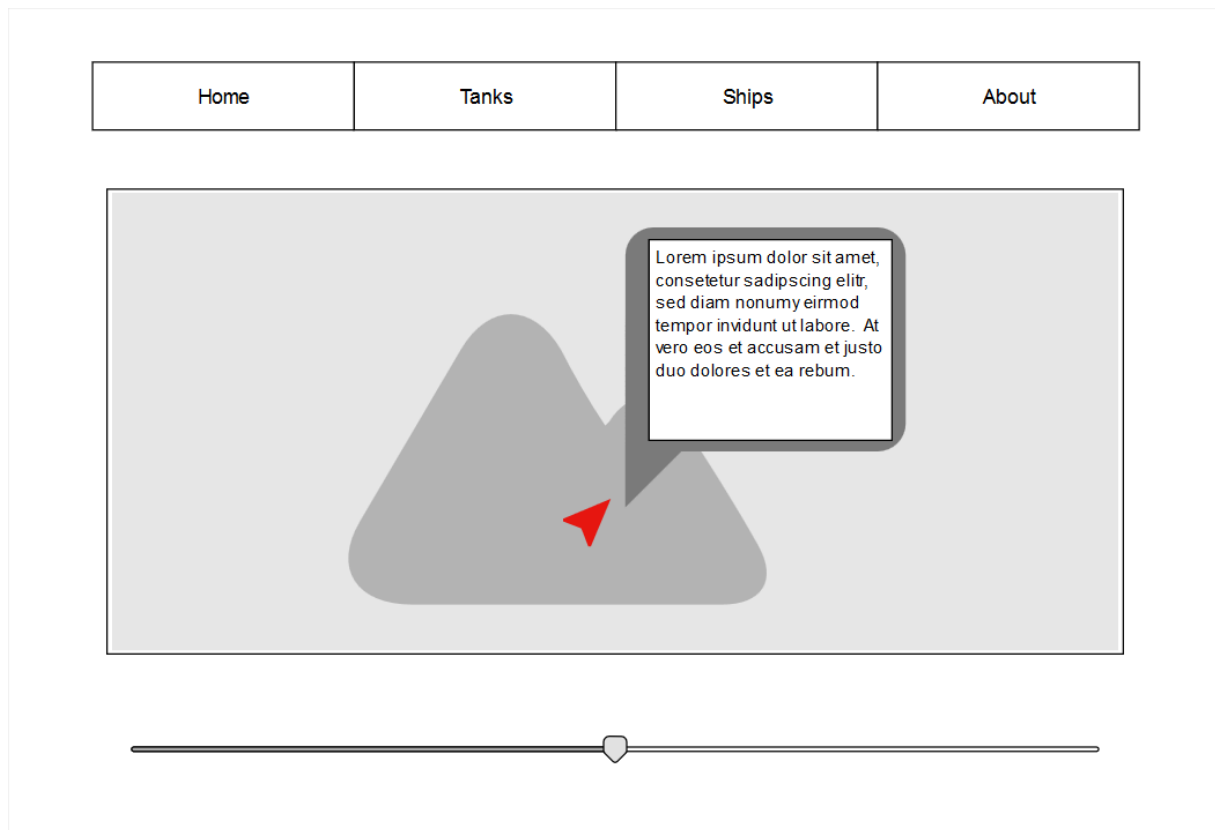
These images culminated into the first draft:

Figure 5. *Mockup web interface* [Illustration]. Own creation.

Figure 6. *Interface alpha 1.0* [Screenshot]. Own creation.

Figure 7. *Interface alpha 2.7(latest before beta)* **[Screenshot]. Own creation.**
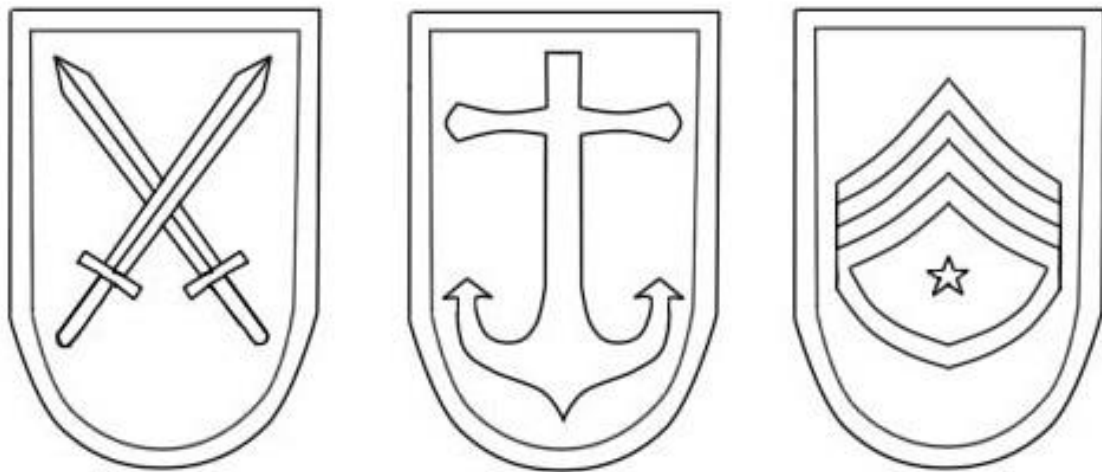

Figure 8. *Icon draft 2.2(latest before beta)* **[Illustration]. Own creation.**

Information and Data

To assemble the required database structure, multiple sources had to be analyzed.

THOR_WW2_DATA

A collection of different THOR (Theater History of Operations Reports) information as .csv files. The focus of this data is on aerial bombings and aircraft, as well as guns used during World War Two.
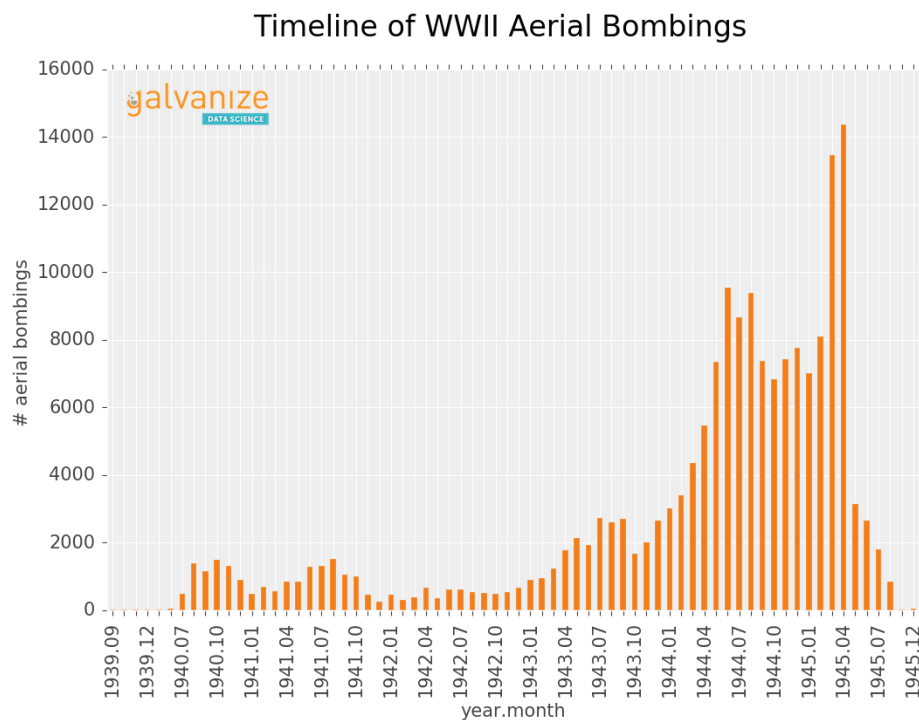

Figure 9. *timeline_of_aerial_bombings.png* **[Infographic].**

In the project, this data was used to gain a general overview and to further assess the project's future and objective.

Wikipedia list of World War II military operations

A comprehensive list of military operations during World War Two. It was used as a guideline and reference point.

Wikipedia Category: World War II

This general overview of World War Two was utilized as an assessment point for the project's data and viability.

Wikipedia Category: Einsatzgruppen

An overview of infantry in World War Two. The article was used to evaluate the integration of infantry data into the project.

Tanks.net

Source for comprehensive World War Two data on battles and machinery used. Utilized for screening and reviewing of data implemented in the project

Due to the vast supply of information, which was not in the required format for the objective of the project, all entities were manually created. This allowed customization and the desired level of detail appropriate for the project.

Developing the database design and refining the data available simultaneously, resulted in the highest quality of suitable data for further use.

Database design

As elaborated, the process of refining data allowed for more suitable entities to be developed and to detail the data required for the project's use. This process concluded in a draft and the final design of the database.
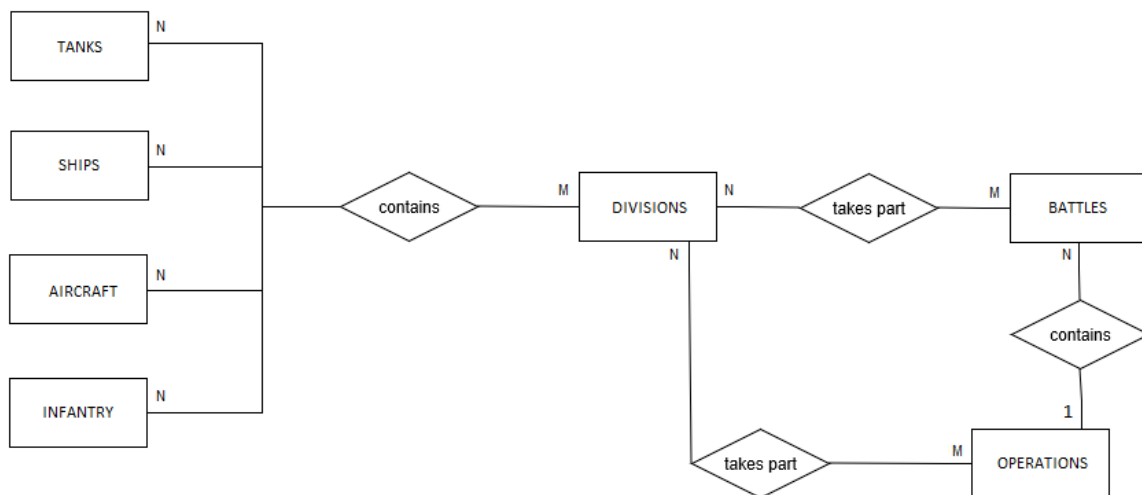

Figure 10. *Chen-Notation (draft)* [Illustration]. Own Creation.

The final Chen-Notation featured fewer entities to support a superior quality product, and focus on a more sophisticated and viable data evaluation.
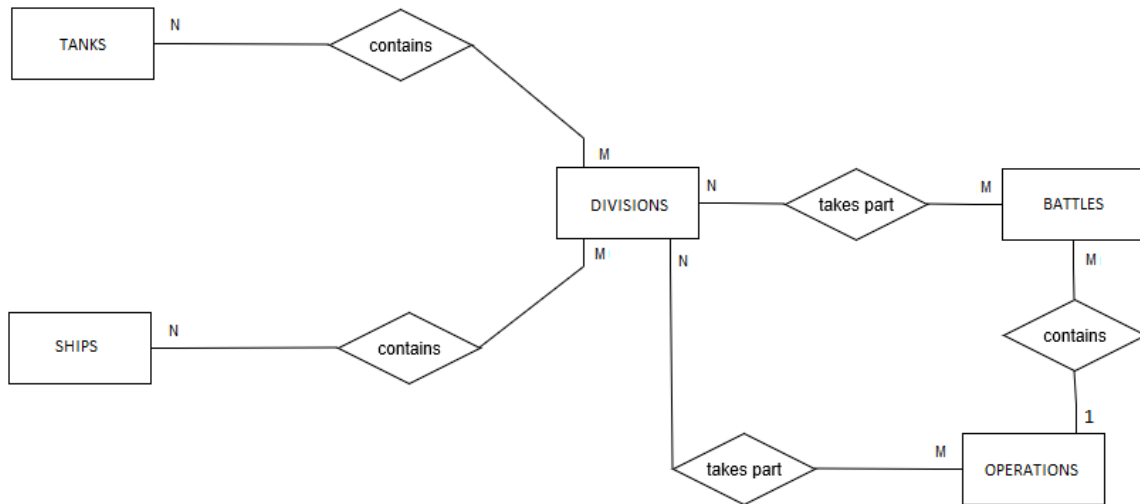
Figure 11. *Chen-Notation (final)* **[Illustration]. Own Creation.**

Likewise, the development of the Crow's-Foot notation followed a similar process as the design of the Chen-Notation. First featuring a draft, and subsequently a more sophisticated finalized version.

Figure 12. *Crow's-Foot notation(draft)* **[Illustration]. Own creation.**

As indicated, the final version features a further revised structure and improved keys.

Figure 13. *Crow's-Foot notation(final)* **[Illustration]. Own creation.**

Normalization

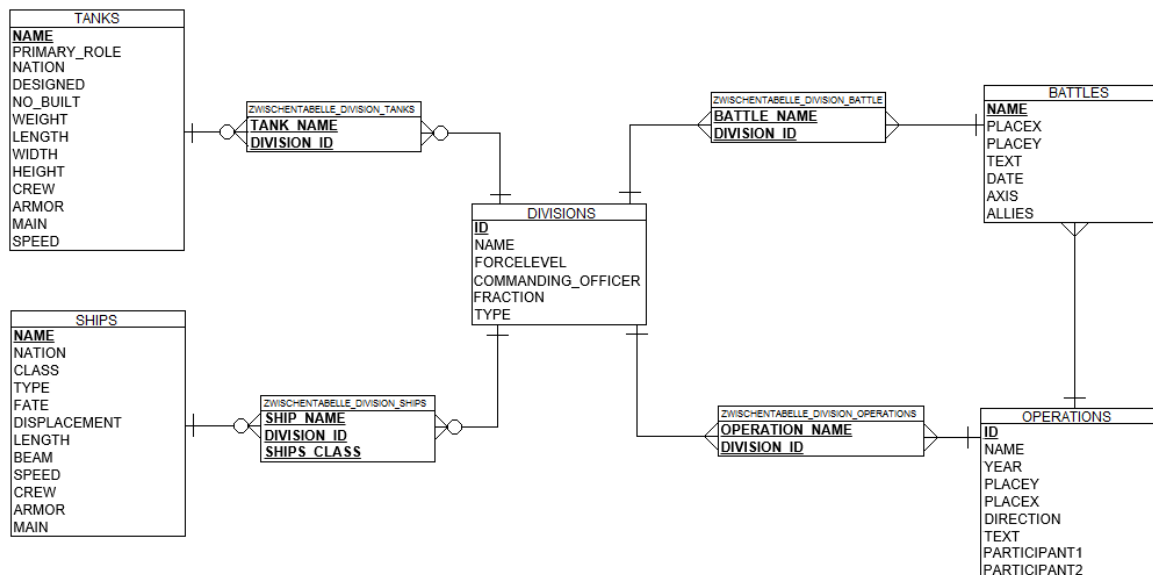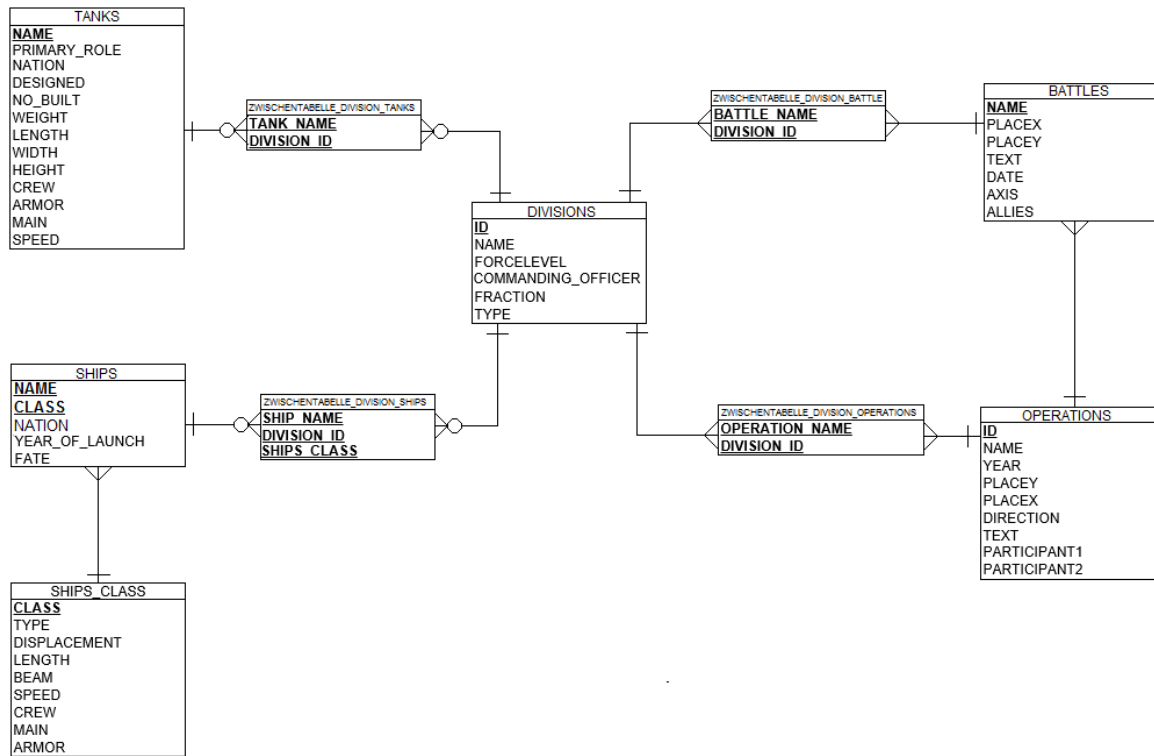The most efficient use of data tables is achieved by initially normalizing each table into the Third Normal Form. The following process details each step of the normalization process. Due to the large quantity of data, only a selection of representative sets are shown.

Normalization - SHIPS
Non-normalized form:

NAME	NATION	CLASS	YEAR_OF_LAUNCH	FATE	TYPE	DISPLACE-MENT
Helena	United States	Saint Louis	1939	Sunk 6.7.1943	Light Cruiser	10000
Helena	United States	Baltimore	1939	Sold for Scrap 1974	Heavy Cruiser	14733
Baltimore	United States	Baltimore	1942	Scrapped 1972	Heavy Cruiser	14733
Canberra	Australia	County	1943	Scuttled 1942	Heavy Cruiser	10400
Provence	France	Bretagne	1913	Scuttled 1942	Battleship	23936
Bismarck	Germany	Bismarck	1939	Sunk 27.5.1941	Battleship	41000
Tirpitz	Germany	Bismarck	1936	Sunk 12.11.1944	Battleship	4100

Table 1. SHIPS Table – Non-normalized (Part 1/2)

LENGTH	BEAM [m]	SPEED	CREW	MAIN	ARMOR
185	18.8	33	888	15xMark 16/1 triple 6-inch/47 Turret	25-355
205.26	21.59	33	1146	9x8-ich/55Mark 15 guns	38-152
205.26	21.59	33	1146	9x8-ich/55Mark 15 guns	38-152
180	21	31.5	784	8xBL 8-inch Mk. VIII guns in twin mounts Mk. I	25-110
166	26.9	20	1190	10x340mm/45 Model 1912 guns	40-340
241.6	36	30	2065	8x38cm SK C/34	100-320
241.6	36	30	2065	8x38cm SK C/34	100-320

Table 2. SHIPS Table – Non-normalized (Part 2/2)

First Normal Form:

To satisfy the criteria of the First Normal Form, the domain for each attribute ought to contain only atomic values. Repeating groups are not allowed in individual data sets and each must have a distinctive primary key.

SHIPS Table already meets the atomic values criteria and does not incorporate any repeating groups. Therefore, it is only necessary to set a **primary key**.

NAME	NATION	CLASS	YEAR_OF_LAUNCH	FATE	TYPE	DISPLACE-MENT
Helena	United States	Saint Louis	1939	Sunk 6.7.1943	Light Cruiser	10000
Helena	United States	Baltimore	1939	Sold for Scrap 1974	Heavy Cruiser	14733
Baltimore	United States	Baltimore	1942	Scrapped 1972	Heavy Cruiser	14733
Canberra	Australia	County	1943	Scuttled 1942	Heavy Cruiser	10400
Provence	France	Bretagne	1913	Scuttled 1942	Battleship	23936
Bismarck	Germany	Bismarck	1939	Sunk 27.5.1941	Battleship	41000
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• • •

Table 3. SHIPS Table – First Normal Form (Part 1/2)

• • •

LENGTH	BEAM	SPEED	CREW	MAIN	ARMOR
185	18.8	33	888	15xMark 16/1 triple 6-inch/47 Turret	25-355
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166	26.9	20	1190	10x340mm/45 Model 1912 guns	40-340
241.6	36	30	2065	8x38cm SK C/34	100-320
241.6	36	30	2065	8x38cm SK C/34	100-320

Table 4. SHIPS Table – First Normal Form (Part 2/2)

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Second Normal Form:

To suit the criteria of the Second Normal Form, a table must be in the First Normal Form. Additionally, every non-prime attribute needs to be fully functionally dependent of every primary key.

SHIPS Table does not yet meet these requirements.

<u>NAME</u>	NATION	<u>CLASS</u>	YEAR_OF_LAUNCH	FATE	TYPE	DISPLACE-MENT
Helena	United States	Saint Louis	1939	Sunk 6.7.1943	Light Cruiser	10000
Helena	United States	Baltimore	1939	Sold for Scrap 1974	Heavy Cruiser	14733
Baltimore	United States	Baltimore	1942	Scrapped 1972	Heavy Cruiser	14733
Canberra	Australia	County	1943	Scuttled 1942	Heavy Cruiser	10400
Provence	France	Bretagne	1913	Scuttled 1942	Battleship	23936
Bismarck	Germany	Bismarck	1939	Sunk 27.5.1941	Battleship	41000
Tirpitz	Germany	Bismarck	1936	Sunk 12.11.1944	Battleship	4100

Table 5. SHIPS Table – Second Normal Form [Step 1] (Part 1/2)

...

LENGTH	BEAM	SPEED	CREW	MAIN	ARMOR
185	18.8	33	888	15xMark 16/1 triple 6-inch/47 Turret	25-355
205.26	21.59	33	1146	9x8-ich/55Mark 15 guns	38-152
205.26	21.59	33	1146	9x8-ich/55Mark 15 guns	38-152
180	21	31.5	784	8xBL 8-inch Mk. VIII guns in twin mounts Mk. I	25-110
166	26.9	20	1190	10x340mm/45 Model 1912 guns	40-340
241.6	36	30	2065	8x38cm SK C/34	100-320
241.6	36	30	2065	8x38cm SK C/34	100-320

...

Table 6. SHIPS Table – Second Normal Form [Step 1] (Part 2/2)

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{NAME, CLASS} ->> {NATION, YEAR_OF_LAUNCH, FATE}
{CLASS} ->> {TYPE, DISPLACEMENT, LENGTH, BEAM, SPEED, CREW, MAIN, ARMOR}

Attributes such as DISPLACEMENT, LENGTH, BEAM, etc. are solely dependent of CLASS. Therefore, SHIPS had to be split into SHIPS and SHIPS_CLASS.

NAME	NATION	CLASS	YEAR_OF_LAUNCH	FATE
Helena	United States	Saint Louis	1939	Sunk 6.7.1943
Helena	United States	Baltimore	1939	Sold for Scrap 1974
Baltimore	United States	Baltimore	1942	Scrapped 1972
Canberra	Australia	County	1943	Scuttled 1942
Provence	France	Bretagne	1913	Scuttled 1942
Bismarck	Germany	Bismarck	1939	Sunk 27.5.1941
Tirpitz	Germany	Bismarck	1936	Sunk 12.11.1944

Table 7. SHIPS Table – Second Normal Form [Step 2]

CLASS	TYPE	DISPLACEMENT	LENGTH	BEAM	SPEED	CREW	MAIN	ARMOR
Saint Louis	Light Cruiser	10000	185	18.8	33	888	15xMark 16/1 triple 6-inch/47 Turret	25-355
Baltimore	Heavy Cruiser	14733	205.26	21.59	33	1146	9x8-ich/55Mark 15 guns	38-152
County	Heavy Cruiser	10400	180	21	31.5	784	8xBL 8-inch Mk. VIII guns in twin mounts Mk. I	25-110
Bretagne	BATTLE-ship	23936	166	26.9	20	1190	10x340mm/45 Model 1912 guns	40-340
Bismarck	BATTLE-ship	41000	241.6	36	30	2065	8x38cm SK C/34	100-320

Table 8. SHIPS_CLASS Table

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Third Normal Form:

Tables of the Second Normal Form are necessary to generate Third Normal Form tables, as well as no transitive dependencies between non-primary attributes and primary keys. That is: Every non-primary attribute is exclusively dependent on the primary keys and not on any other non-primary attribute.

SHIPS and SHIPS_CLASS require no further transformation, since they are already in the Third Normal Form.

Normalization - TANKS

Non-normalized Form:

NAME	PRIMARY_ROLE	NATION	DESIGNED	NO_BUILD	WEIGHT	LENGTH
T-18	Light Tank	Russia	1927	96	5.9	4.38
R35	Light Tank	France	1934	1540	10.6	4.02
Valentine Bishop	Self-propelled Gun	United Kingdom	1942	100	17	5.53
Ram	Medium Tank	Canada	1941	2032	29	5.8
T-35	Heavy Tank	Russia	1930	61	45	9.72
Sturmge-schütz III	Assault Gun	Germany	1936	10086	23.9	6.85
PzKpfw IV	Medium Tank	Germany	1936	9553	25	5.92

Table 9. TANKS Table – Non-normalized (Part 1/2)

WIDTH	HEIGHT	CREW	ARMOR	MAIN	SPEED
1.76	2.10	2	6-16	37mm Model 28	17
1.87	2.12	2	43	37mm SA 18 gun	25
2.63	8.83	4	8-60	QF 25pdr howitzer	24
3	2.67	5	25-87	QF 6 pdr	25
3.20	3.43	11	11-30	76.2mm gun model 27/32	30
2.95	2.16	4	16-80	7.5cm StuK 40	40
2.88	2.68	5	10-80	7.5cm KwK	42

Table 10. TANKS Table – Non-normalized (Part 2/2)

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It can already be determined that all attributes are atomic, no repeating groups occur, and NAME is the singular primary key. In consequence, TANKS is in the First Normal Form.

Because all non-prime attributes are fully functionally dependent on the primary key as well, it can be concluded that the entity is also already in the Second Normal Form.

{NAME} ->> {PRIMARY_ROLE, NATION, DESIGNED, NO_BUILD, WEIGHT, LENGTH, WIDTH, HEIGHT, CREW, ARMOR, MAIN, SPEED}

No transitive dependencies exist in this entity, therefore it is in the Third Normal Form and no further transformation is necessary.

NAME	PRIMARY_ROLE	NATION	DESIGNED	NO_BUILD	WEIGHT	LENGTH
T-18	Light Tank	Russia	1927	96	5.9	4.38
R35	Light Tank	France	1934	1540	10.6	4.02
Valentine Bishop	Self-propelled Gun	United Kingdom	1942	100	17	5.53
Ram	Medium Tank	Canada	1941	2032	29	5.8
T-35	Heavy Tank	Russia	1930	61	45	9.72
Sturmge-schütz III	Assault Gun	Germany	1936	10086	23.9	6.85
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. . .

Table 11. TANKS Table – Third Normal Form (Part 1/2)

WIDTH	HEIGHT	CREW	ARMOR [	MAIN	SPEED
1.76	2.10	2	6-16	37mm Model 28	17
1.87	2.12	2	43	37mm SA 18 gun	25
2.63	8.83	4	8-60	QF 25pdr howitzer	24
3	2.67	5	25-87	QF 6 pdr	25
3.20	3.43	11	11-30	76.2mm gun model 27/32	30
2.95	2.16	4	16-80	7.5cm StuK 40	40
2.88	2.68	5	10-80	7.5cm KwK	42

. . .

Table 12. TANKS Table – Third Normal Form (Part 2/2)

Normalized Tables

The following entities already fulfil the criteria of the First, Second, and Third Normal Form and therefore do not need any further optimization.

ID	NAME	FORCELEVEL	COMMANDING_OFFICER	FRACTION	TYPE
1	Sturzkampfgeschwader 76	29 Junker Ju 87B	Captain Walter Sigel	German	Land
2	Sturzkampfgeschwader 2 Immermann	29 Stukas	Major Oskar Dinort	German	Land
3	Luftwaffe	400 Bombers	Mayor General Wolfram von Richthofen	German	Land
4	Burza, Blyskawica, Grom	3 Destroyers	Unknown	Polish	Water
5	Unknown	5 Submarinew	Adam Mohuczy	Polish	Water

Table 13. DIVISIONS Table – Third Normal Form

{ID} ->> {NAME, FORCELEVEL, COMMANDING_OFFICER, FACTION, TYPE}

NAME	DATE	PLACEX	PLACEY	AXIS	ALLIES	TEXT
Battle of Berlin	1945	-440	925	Germany	UdSSR	The final major …
Battle of Okinawa	1945	-570	1480	Japan	United States	Capture of the …
Battle of Khalkin Gol	1939	-470	450	Japan	UdSSR	The decisive …
Battle of Leyte Gulf	1944	-625	1470	Japan	United States	Largest naval battle …
Battle of Midway	1942	-550	1700	Germany	United States	Decisive naval …

Table 14. BATTLES Table – Third Normal Form

{NAME} ->> {DATE, PLACEX, PLACEY, AXIS, ALLIES, TEXT}

ID	NAME	YEAR	PLACEY	PLACEX	DIREC-TION	TEXT	PARTICI-PANT1	PARTICI-PANT2
1	Fall Rot	1939	-450	970	90	German bombing …	Germany	
4	Operation Dirschau	1939	-420	980	90	German operation to …	Germany	
6	Operation Ost	1939	-450	975	90	German operation in …	Germany	
12	Operation Aida	1942	-575	1020	135	AXIS attacks in …	Germany	Italy
22	Operation Torch	1942	-550	825	165	Soviet offensive …	United Kingdom	United States

Table 15. OPERATIONS Table – Third Normal Form

{ID} ->> {NAME, YEAR, PLACEY, PLACEX, DIRECTION, TEXT, PARTICIPANT1, PARTICIPANT2}

Temporary Tables

DIVISION_ID	SHIP_NAME	SHIP_CLASS
8	Activity	Activity
47	Fuso	Fuso
47	Yamashiro	Fuso
29	Furutaka	Furutaka
29	Aoba	Furutaka

Table 16. ZWISCHENTABELLE_DIVISION_SHIPS Table

DIVISION_ID	TANK_NAME
8	M13/40
44	Cruiser Mk IV
44	Infantry Mk II Matilda
23	PzKpfw Tiger Ausf. B 'Tiger I'
23	PzKpfw V Panther

Table 17. ZWISCHENTABELLE_DIVISION_TANKS Table

BATTLE_NAME	DIVISION_ID
Battle of Leyte Gulf	47
Battle of Leyte Gulf	48
Battle of Berlin	17
Battle of Berlin	18
Battle of Khalkin Gol	19

Table 18. ZWISCHENTABELLE_DIVISION_BATTLE Table

OPERATION_ID	DIVISION_ID
1	1
10	4
11	5
12	8
12	9

Table 19. ZWISCHENTABELLE_DIVISION_OPERATION Table

Implementation and SQL-Query

Before the normalized database could be used, a website with an interactive map, slider, and a navigation bar had to be created.

At first, a basic HTML document was set up, featuring a navigation bar and an interactive slider using the libraries of W3-schools and Bootstrap. After assessing a variety of libraries and possible solutions, it was decided to use the open-source JavaScript library *Leaflet* for development of the interactive map feature. With further research into modifying the framework to the project's needs, it became possible to make efficient use of the library for the implementation of the desired functionalities.

The *Eclipse* environment was used for the development process. Testing was done through a localized *Wamp* sever.

Once the environment had been set up, the normalized database could now be implemented into the project.

To achieve this, "MySQL Workbench" was utilized to import .csv data tables and host them on a webserver, which was provided by the HAW Hamburg. Once uploaded, the database was connected to the website via PHP script.

```php
<?php

    $conn=new mysqli("pstud0.mt.haw-hamburg.de","aca083",          ,"aca083");
    if ($conn->connect_error) {
        die("Connection failed: " . $conn->connect_error);
    }
?>
```
Code Snippet 1. Connecting database and website via PHP

Since most of the website and its functionalities are based on JavaScript, database requests could not be executed directly. PHP scripts are called via jQuery and Ajax, which were implemented into the JavaScript base construct. These PHP scripts generate database requests and send the received data back to the JavaScript functions.

Slider.js registers the year the slider is set to and directs a database request to db-request.php. On receiving the requested data, it sets the operations, battles and divisions to the right location on the interactive map.

```
//1945
if(sliderValue==6){
        var image = L.imageOverlay('Images/1945sep.png', bounds).addTo(map);

        $.post("PHP/db-
requests.php",{type:"operations",year:"1945"},function(data){
                        setOperations(data);
                });
        $.post("PHP/db-requests.php",{type:"battles", year:"1945"},function(data){
                        setBattles(data);
                });

        resetDivisions();
        $.post("PHP/db-requests.php",{type:"divisions-via-operations",
        year:"1945"},function(data){
                        setDivisions(data);
                });
        $.post("PHP/db-requests.php",{type:"divisions-via-battles",
        year:"1945"},function(data){
                        setDivisions(data);
                });


        }
        $.post("PHP/db-
requests.php",{type:"operations",year:"1945"},function(data){
                        setOperations(data);
                });
}
```
Code Snippet 2. Slider to database request

The db-request.php script receives the POST from slider.js and sends a database request, inquiring attributes for all the operations that took place in that given year. After obtaining the data, PHP transforms it into a JSON-array and sends it back to slider.js.

```php
if($_POST['type']==='operations')
{
        $sql = "SELECT ID, NAME, PLACEY, PLACEX, TEXT FROM OPERATIONS WHERE
        YEAR=".$_POST['year'];

        $result = $conn->query($sql);
        $json_array=null;
        if ($result->num_rows > 0) {
                // output data of each row
                $results=array();
                while($row = $result->fetch_assoc()) {
                        $results[]=$row;
                }
                $json_array = json_encode($results);
        } else {}
        if($json_array!=null)
        {echo $json_array;}
}
```
Code Snippet 3. Database request for Operations

The script requesting data on all the divisions in any given year is more complex. Divisions cannot be accessed via the year, but only through battles and operations in the same year. Two database requests were necessary to accomplish this. One, to get all relevant divisions that took part in a given battle, and second, to get all the divisions that took part in an operation.

```php
if($_POST['type']==='divisions-via-operations')
{
        $sql = "SELECT
                        DIVISIONS.ID,
                        DIVISIONS.NAME,
                        DIVISIONS.FORCELEVEL,
                        DIVISIONS.COMMANDING_OFFICER,
                        DIVISIONS.TYPE,
                        OPERATIONS.PLACEY,
                        OPERATIONS.PLACEX
                    FROM
                        DIVISION,
                        OPERATIONS,
                        ZWISCHENTABELLE_DIVISION_OPERATIONS
                    WHERE
                        OPERATIONS.YEAR =".$_POST['year']."
                        AND OPERATIONS.ID =
                        ZWISCHENTABELLE_DIVISION_OPERATIONS.OPERATION_ID
                        AND DIVISION.ID =
                        ZWISCHENTABELLE_DIVISION_OPERATIONS.DIVISION_ID";
        $result = $conn->query($sql);
        $json_array=null;
        if ($result->num_rows > 0) {
                // output data of each row
```

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```
                  $results=array();
                  while($row = $result->fetch_assoc()) {
                        $results[]=$row;
                  }
                  $json_array = json_encode($results);
            } else {}
      if($json_array!=null)
      {echo $json_array;}
 }
```

Code Snippet 4. Accessing divisions via operations taking place in a given year

Values such as PLACEX and PLACEY are required for development purposes only and were created to indicate the position of any operation or battle on the interactive map.

After gathering all the information available for Battles, Operations, and Divisions, and placing them on the map according to their X and Y values, the next step was to configure the popups. The purpose of this was to have a clickable feature which displays specific information for each individual indicator.

Since each division's popup is required to list all of its associated ships and tanks, a few more database requests were necessary. By iterating through every division using JavaScript and sending requests to the PHP script, all information according to each division was made accessible.

```
$.post("PHP/db-requests.php",{type:"ships",
division:zAktuelleDivisions[i].ID,nummer:i},function(ships) {[...]}
$.post("PHP/db-requests.php",{type:"tanks",
division:zAktuelleDivisions[pDivNum].ID,nummer:pDivNum},function(tanks) {[...]}
```
Code Snippet 5. Request data of all ships and tanks in certain divisions [part of map.js]


```
if($_POST['type']==='ships')
{
      $sql = "SELECT
            ZWISCHENTABELLE_DIVISION_SHIPS.DIVISION_ID,
            ZWISCHENTABELLE_DIVISION_SHIPS.ANZAHL,
            SHIPS.*,
            SHIPSCLASS.*
      FROM
            ZWISCHENTABELLE_DIVISION_SHIPS,
            SHIPS,
            SHIPSCLASS
      WHERE
            ZWISCHENTABELLE_DIVISION_SHIPS.DIVISION_ID".$_POST['division']."
            AND SHIPS.NAME = ZWISCHENTABELLE_DIVISION_SHIPS.SHIPS _NAME
            AND SHIPS.CLASS = ZWISCHENTABELLE_DIVISION_SHIPS.SHIPS _CLASS
            AND SHIPSCLASS.CLASS= SHIPS.CLASS";
      $result = $conn->query($sql);
      $json_array=null;
      if ($result->num_rows > 0) {
            // output data of each row
            $results=array();
            while($row = $result->fetch_assoc()) {
                  $results[]=$row;
            }
      }
```

```php
        $results[]=array('nummer'=>$_POST['nummer']);
        $json_array = json_encode($results);
        if($json_array!=null)
        {echo $json_array;}
 }
```

Code Snippet 6. Request for ships of certain divisions [part of db-request.php]

As an additional feature the user should be able to access the data of all ships and tanks in the form of a table. For this, the framework DataTables was used. The database requests for ships and tanks are identical in this feature.

```php
 if($_POST['type']==='shipsAll')
 {
        $sql = "SELECT
                    *
              FROM
                    SHIPS,
                    SHIPSCLASS
              WHERE
                    SHIPS.CLASS = SHIPSCLASS.CLASS";
        $result = $conn->query($sql);
        $json_array=null;
        if ($result->num_rows > 0) {
                // output data of each row
                $results=array();
                while($row = $result->fetch_assoc()) {
                        $results[]=$row;
                }
        }
        $json_array = json_encode($results);
        if($json_array!=null)
        {echo $json_array;}
 }
```

Code Snippet 7. DataTables request - SHIPS

Frontend and Demonstration

This website can be viewed at: http://aca083.pstud0.mt.haw-hamburg.de/

The interactive map was created using the JavaScript leaflet-framework. This feature allows the user to move the map via drag and drop. To zoom, the user either clicks on the "+" or "- " in the top left-hand corner of the map or simply scrolls using his mouse wheel.

A legend for the map is located in the top right-hand corner of the map. It reveals the correlation between colour and faction as well as indicates the implication for each icon.

A slider is located at the bottom of the screen. It serves as a tool to switch between the years of 1939 and 1945. Depending on the chosen year, the map changes accordingly and displays the associated events and borders. This results in a limited set of data to be visible at any given time preventing an overflow of information. Furthermore, it sorts events and units by year and supports a better overview of the historic timeline.

Figure 14. *Final interface (Home)* [Screenshot]. Own creation.

All icons are interactive and will open a pop-up upon being clicked. The popup itself features further information. For instance, a divisions pop-up will contain its name, faction, commanding officer, along with a list of vehicles or ships. Every listed vehicle or ship can be clicked to view further information about that specific unit.

Figure 15. *Final interface (Home including Popup)* **[Screenshot]. Own creation.**

Access to the entire list of ships and tanks used in World War Two, is obtained by clicking on either "TANKS" or "Ships" at the top of the screen. A search bar in the top right-hand corner of the window allows the user to search for any desired information on specific values, such as ships or nations. A drop-down menu in the top left-hand corner can be used to set the number of visible entries.

Figure 16. *Final interface (SHIPS)* **[Screenshot]. Own creation.**

Resume

The main objective of this project was to gain and improve knowledge on how to implement a database into a web application. This was achieved to a satisfactorily degree. HTML, CSS and JavaScript competence was improved and insight gained into database normalization and implementation via PHP and SQL.

The second objective was to create a fun and yet still educational website about the most decisive events and participants of the Second World War. By creating an interactive map, the information can be viewed comfortably and effortlessly. This was done by creating an intuitive website design and keeping presentation as well as interaction complexity at a moderate level. Elements such as the slider, allow the user to *walk through history* and consequently create an easy environment to explore. Therefore, the second objective of the project was achieved.

Over the course of this project it became clear that assessing the available information of the Second World War, allows anyone to create comprehensive historical applications. Varying amounts of effort were required to achieve the desired result.

Furthermore, working on a group project allowed to gain experience in task assignment, management, as well as research processes and problem solutions. The fact that several ~~separate~~ groups had relatable objectives and tasks made exchange possible and led to a better understanding and higher quality project.

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