

INTERACTIVE INFORMATION DESIGN

An application used to illuminate the environmental effects of the Syrian War

by Ece Karaca

MFA Candidate, Department of Design

The Ohio State University

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Abstract: Interactive information design and data visualization is a visualization method which requires the efficient display of complex data sets using design principles, data analysis, technological tools like programming and creative coding. In this research, the environmental effects of the Syrian war are displayed in an interactive, digital setting. This case study reflects only a small amount of the current damage in Syria, giving an overall idea about the catastrophic effects of military activities. The visualization was created based on PAX for Peace organization's "Amidst the Debris, A Desktop Study on the Environmental and Public Health Impact of Syria's Conflict" report.

Keywords: interaction design, information design, data visualization, environment, environmental effects of war, Syrian Conflict.

1. Introduction

Data visualization is a method of organizing complex information and data to display in a visual context. Creative methods used to display qualitative and quantitative data to enable the viewer to see and understand complex data sets in quick and efficient ways. Data visualization is anchored around a visual representation using different digital medium that technology offers such as sound, motion, video, touchscreen, and so forth. Moreover, it will be accurate to name the data visualization as a system formed by the complex variables, creating a whole piece together. As the visualization system shows key points and different levels of the data set concurrently, the system can be used as a tool to discuss and analyze its points. Furthermore,

data visualization can be applied to social development and change. It plays an important role in the decision making process since a data visualization offers a broad spectrum of application and communication opportunities.

As Mikey Dickerson stated in his talk at the *Velocity NY 2014 Keynote*:

“Our country is a place where we allocate our resources through the collective decisions that all of us make... We allocate our resources to the point where we have thousands of engineers working on things like picture-sharing apps, when we've already got dozens of picture-sharing apps. We do not allocate anybody to problems like...Food stamp distribution, Federal Pensions, Immigration....” [2]

I agree with Dickerson's thinking, this is our world and there are lots of things we can do to better address more important global problems. Maybe not necessarily changing the world directly, but we can use our skills to create awareness, inform others, and empower organizations and policy makers to contribute smarter, more informed decisions.

As a designer, I believe I have a responsibility of using creative means to facilitate social development and change. By creating interactive tools, it is possible to enable the general public to navigate a complex issue more quickly and easily. Combining technology, analysis, design tools and techniques, I investigated the interactive data visualization techniques to illuminate the environmental effects of the Syrian War.

As one of the many inspirations behind this study researcher, system creator and engineer, Bret Victor asks “What are the powerful ways of seeing? How people can see actively what things are doing?” (“Seeing Spaces”). I aimed to show the damage given to the environment by

military activities, by using my expertise and investigating better ways to understand the complex, multi-faceted situations. Dynamic mediums offer an advanced level of engagement through data visualization.

2. Research Method

Information design and data visualization used to be solely on 2D, flat surfaces that are aimed to be read by the viewers, through one-way communication that do not necessarily ease or enable the viewer to see specific details. Today, technology offers more, and enables the creators to communicate information in different ways. Reflected by A. Black, et. al.:

“An interactive information graphic is a visual representation of information that integrates different modes – e.g. image (which is the constitutive element), written text, sound, layout – into a coherent whole and offers at least one navigation option to control the graphic; its communicative function is to inform, e.g. by describing or explaining something or narrating a factual story.” (Black, et.al. pp. 69).

Interactive data visualization can be used to guide the viewer through complex information and data. In my research I focus on **creating an interactive data visualization system that increases our understanding of multi-faceted, dynamic situations**. Through practice based research, I investigate the ways to visualize and present complex data using technology, analysis and design thinking -- the process of creating and practicing directly influence the development of the project. Practice-based research is key to the investigation of new visualization techniques. As observed:

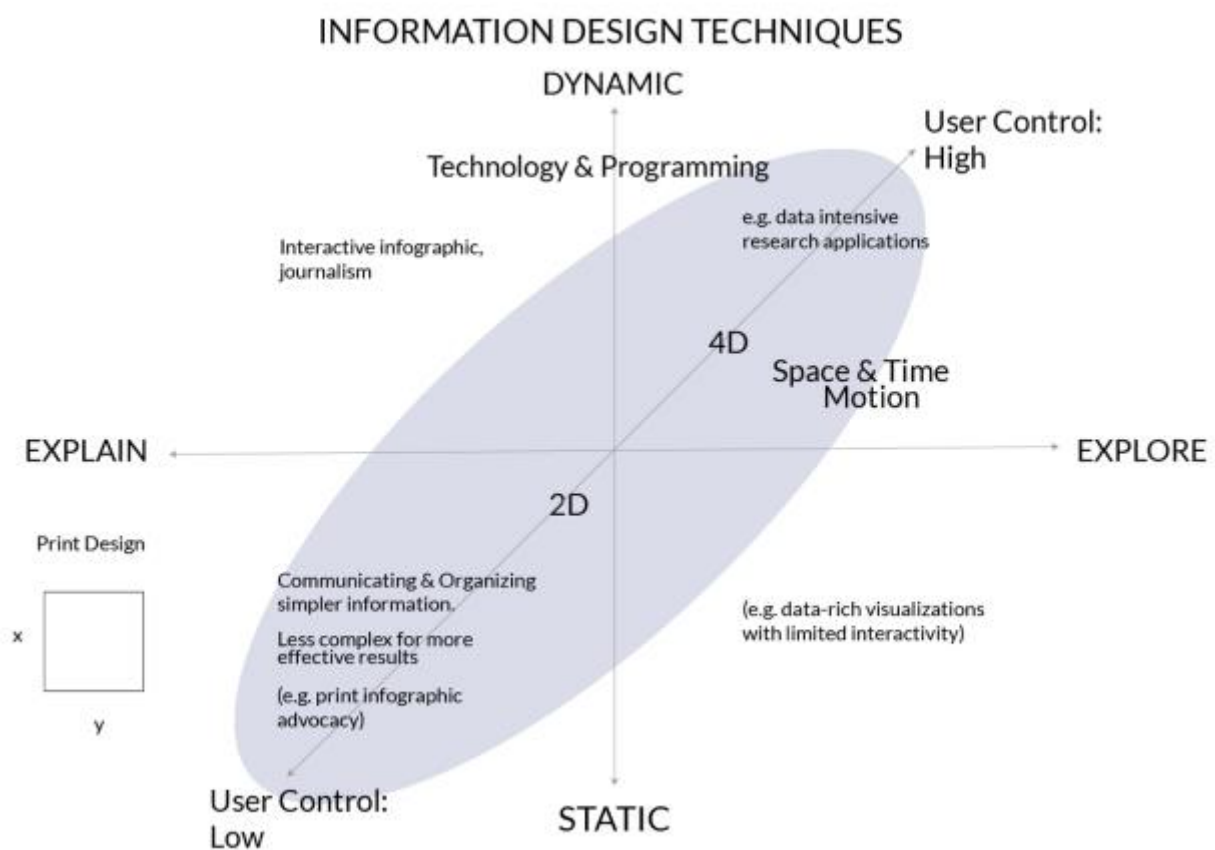
"Artworks are often complex, multilayered and resonant. Accordingly, there are several possible lines of research inquiry, some perhaps compositional, some technological, some involving performance qualities, and others conceptual. This is where, in the first instance a clue to the intended research inquiry is additionally needed. Many insights emerge in the processes of making and doing." (Robin, pp. 27).

Documentation and prototyping facilitate new discoveries and discussions through the working process, since it enables different ways of seeing and observing critical reflections in a timeline. Consequently, my creative inquiry was evolved throughout the research process. A data table, a statistic, or a chart, offer different ways to consume information. Effective data visualization enables us to understand these complex data sets quickly and simultaneously.

“Many information displays report on the world's workaday reality of three-dimensional space and time. Painting four-variable narrations of space-time onto flatland combines two familiar designs; the map, and the time-series. Our strategy for understanding these narrative graphics is to hold constant the underlying information and then to watch how various designs and designers cope with the common data...” (Tufte, pp 97).

As a graphic designer, I focused on working with print media, which is a great resource to communicate and inform the viewers in a one way channel of communication. It is possible to explain and offer visuals to viewers as they can read and learn from it. However, when it comes to complex, dynamic, multifaceted situations print media offers limited access. Aiming to contribute to the future of design, I investigate the data visualization possibilities that technology

offers. The potential of adding more dimensions to a visual representation brings out more exploration and engagement to the data visualization system. The capacity of time, motion and senses can be added to the existing spatial dimensions of design by incorporating technological tools and computing skills. The graph below is taken from *the Information Fusion* article by James and Dasarathy (qtd. in Follett, pp. 99), I modified the graph and added my journey of investigation.



Graph 1. A.P. James, B. V. Dasarathy, Medical Image Fusion (qtd. in Follett, pp. 196)

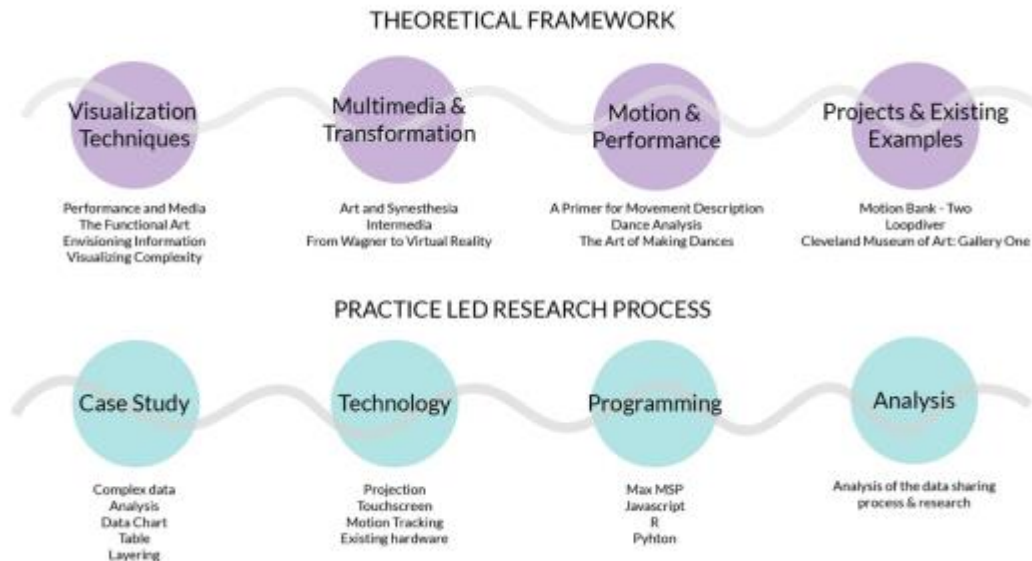
As reflected above, I started design in print media, located on the bottom left corner of the graph, 2D design is great for explaining information in a static setting with low user control. In my graduate studies, I aim to take the work to an exploratory area by giving user a higher

control over dynamic, complex, multi-faceted situations. Technological opportunities like programming offers the integration of time, space and motion to the work. Moreover viewer engagement is supported by moving from static to dynamic data visualization opportunities.

Moving forward to a new area which is displayed on the top right corner of the graph, it is possible to create dynamic data visualizations by using sound, motion, image and reflect on the complex, data heavy resources.

3. Theoretical Framework

I formed the case study by researching and practicing in different categories including visualization, design theory, color theory, multimedia, movement/motion, and existing interactive projects and data visualization examples. The resources guided me to form a project in a dynamic exhibition setting, while considering the future of the information presentation and design.



Graph 2. Theoretical framework and research process graph

The literature review of the dynamic information visualizations, includes a process of working on visualizations and technological applications, documenting my process, and guiding my research. The diagram above shows some of the major resources which reflects my investigation process. All the steps affect and inform my future design decisions and process.

My case study is initially inspired by NASA's *Images of Change* pictures ("Global Climate Change: Images of Change"). The projects use an interactive website used to show the dramatic human impact on environment by enabling the comparison of so-called before and after images. The website almost provides a tool to compare environmental patterns of specific locations around the world, indicating exact dates. Seeing the melting ice sheets or vaporizing lakes have a shocking effect. By sliding the bar on the interface, I came to the realization, this represents how quickly we destroy natural resources. Environmental issues are important because human impact has a tremendous role in the destruction of nature, but also humanity has the power to act on these issues. I started to pay attention to the environmental changes around the world and ask the question: "How can I use visual design to show how humans adversely affect the environment?"

4. Case Study: Visualizing The Environmental Effects of Syrian War

Assuming the environmental effects of war and military activities are significant problems, I decided to use a dataset about the ongoing war in Syria. "Of the past 3,400 years, humans have been entirely at **peace for just 268** of them, or **8 percent** of recorded history" (Hedges), a New York Times article from 2003 shows the tenderability of the human race in war thought history. Meanwhile, little attention is paid to the long-term impact of military activities on the environment and the consequences for the civilians and future generations. We need to

talk more about the environmental pollution caused by war and military activities around the world.

This study is an interactive data visualization project, created with a dataset taken from the PAX for Peace Organization's report about the effects of the Syrian Conflict on the environment and public health. The report provides data on industrial sites that are located in 8 different Syrian cities with details on chemical and hazard types that are released to the environment during the war. Considering the conflict is still ongoing, the report is not complete and it is not possible to track and report in every detail for now. However, the report still gives an overall picture about the catastrophic effects of war. The long term effects that occur outside of immediate loss of life or property have a hidden cost. My focus is only on a small amount of data, being aware that the war itself is related to social, historical, economic, and a myriad of other issues.

“This desktop study does not provide a list of verified “hotspots” of environmental damage. The ongoing war in Syria does not currently allow for systematic field measurements in most areas of concern. What this desktop study does aim to do, is link known civilian exposure scenarios to known cases of possible or probable environmental pollution from the war in Syria. In doing so it considers pollution incidents in other conflicts and examples of peacetime military pollution. It also explores an experimental approach to assessing the toxic footprint of the constituents of conventional munitions” (Zwijnenburg & Kristine, pp. 6).

The complex background of Syrian War can be reflected in the areas of history, political science, economy, etc. There might be hundreds of reasons behind the motivation of starting

wars, but there is only one inevitable result; destruction of the environment, species and humanity.

| | | | | |
|---|---|--|--|--|
| Aleppo, Homs, Hama, Idlib, Raqqa, Damascus. | Defence | Hydrazine, fuel, explosives. | Liquid toxic to the environment, liquid toxic to humans, flammable liquid, toxic/persistent (explosive). | Long term impact, direct impact on life-support functions and nature, direct impact on human health. |
| Towns and cities with damaged electricity distribution sites. | Electricity distribution | Ammonia. | Gas toxic to humans, gas toxic to the environment. | Direct impact on human health, direct impact on life-support functions and nature. |
| Homs, Deir ez-Zor. | Energy production and distribution (steam, propane/butane, oil and solvents, etc) | Natural gas, propane, butane, ammonia. | Flammable gas, gas toxic to the environment, gas toxic to humans. | Direct impact on human health. |
| Homs, Deir ez-Zor. | Gas distribution | Natural gas. | Flammable Gas, gas toxic to the environment | Direct impact on human health. |
| Aleppo. | Glass production | Hydrogen fluoride. | Explosive, solid toxic after contact with water. | Direct impact on human health. |
| Adra, Aleppo. | Iron and steel foundries | Cleaning agents, solvents. | Liquid toxic to the environment, flammable liquid, toxic/persistent, liquid toxic after contact with water, carcinogenic, mutagenic. | Direct impact on human health, direct impact on life-support functions and nature, long-term impact. |
| Deir ez-Zor, Palmyra. | Oil and gas mining (onshore, offshore). | Oil and solvents, natural gas. | Liquid toxic to the environment, toxic/persistent, flammable gas, gas toxic to the environment. | Direct impact on human health. |
| Adra, Aleppo. | Production accumulators and batteries | Mixed chemicals (fire). | Gas toxic to humans, toxic/persistent (toxic smoke). | Direct impact on human health. |

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By using my own expertise, as a designer, I aimed to illuminate the environmental costs, trying to show the complexity of a focused dataset with visual materials.

The report and dataset are extremely valuable resources. As you can see the original data table on the right, textual information in the tabulate format is a challenge that preclude the viewer from seeing a holistic picture about the topic.

Data Appendix (Zwijnenburg & Kristine, pp.89)

5. Application

Sifting through the complex data sets and simplifying the complex information by using color, shape and 2-dimensional mediums is the main design approach in this work. Using information design as a tool and dynamic medium in order to communicate with the audience might catalyze the message giving style of performance arts, and enable viewers to understand the intended message.

The work is presented in a 3-dimensional construct, enabling viewers to interact with data in a physical space. An interactive interface is designed to allow multiple viewers to control

different layers of information on a multi-touch screen that can be integrated into the viewer experience. When the interface is in a passive state, motion detection devices would provide ambient audio cues to viewers both for atmospheric mood and directional guidance.

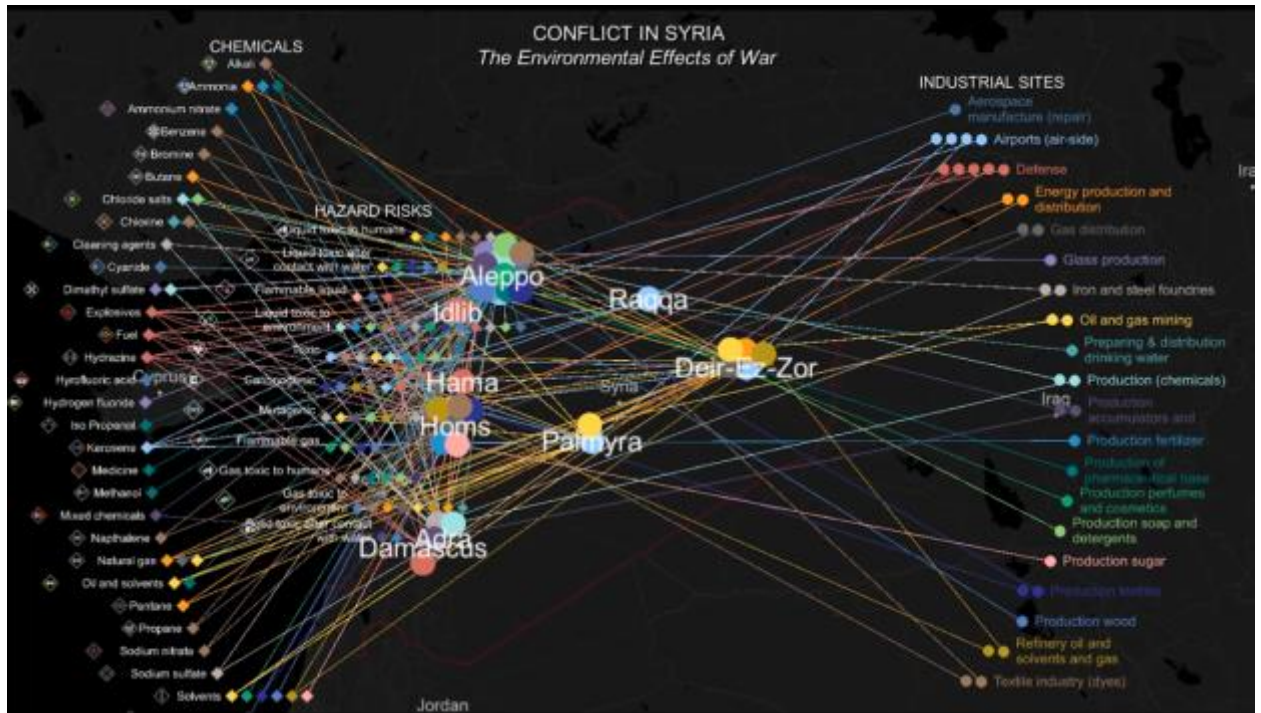


Graph 3. Case study application and the display environment

The application is displayed on a multi-touch screen that allows the viewers to see 21 industrial sites located in 8 different cities around Syria. Sites are displayed on the right side of the layout, chemicals and hazard risks are on the left, all the nodes are displayed according to the approximate coordinates of the industrial sites, providing geographical information. Currently these industrial sites are destroyed, causing various hazard risks and chemical release around the country. All the colored nodes are linked to industrial sites, chemicals and hazard risks. Color coding represents the connection of the chemicals and hazard risks to industrial sites.

These industrial sites were used to provide production of different services and products. They were source of income, economical stability and service. The destruction of these sites cause the release of 30 different chemicals several times which release liquids and gases toxic to

the environment, water and humans. Most of them are flammable, carcinogenic or mutagenic. Therefore, the dataset is defined as complex currently it is not possible to track or quantify the exact numbers of impact. It is possible to diagram the current issues and make predictions or decisions through this design.



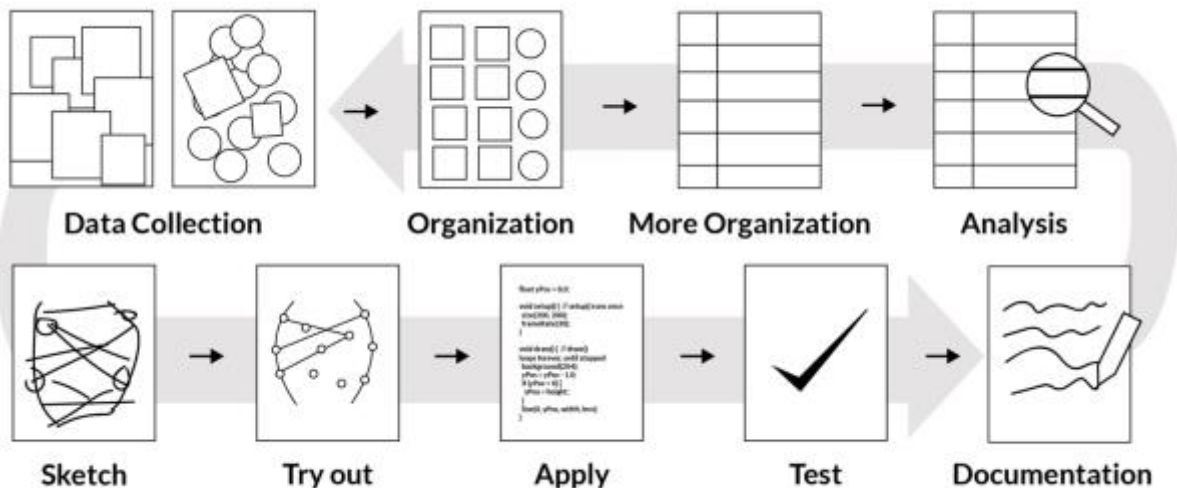
Graph 4. Case Study, a screenshot of interactive visualization, main layout.

The visualization and report show the highly targeted areas that used to function and facilitate the production and economy in Syria. For example, when the viewer touches a red dot on the map, it points out to the corresponding destroyed defense site, which cause the release of explosives, fuel and hydrazine, followed by several hazards risks like the release of flammable liquid and liquids toxic to the environment. If you want to learn more about the chemicals, you can view more information by tapping it. Also, when you tap on the city names, you can see specific pictures from the cities, in addition to the population data from 2004, 2010 and 2016.

The visualization is extremely complex, which reveals the current condition in Syria. The wires connect the related environmental titles together, also symbolizes the chaos in the country.

6. Research Process

The application of the case study begins with finding the accurate data sets intended to reflect the environmental effects of the Syrian War. A data set should be accurate and reliable in the first place, then it can be cleaned and organized to see an overall insight about the variables. Organization and analysis of the data set designates the next steps, the specific information needs to be checked and organized, and if necessary, more data should be collected. After the analysis, sketching and working on the rough visualization prototypes shape the direction of the interface design. Later, the application is created in an interactive setting with 'programming'. The interactive steps should be storyboarded and finalized with testing. This process is a continuous cycle, every step affects each other, forming the final work.



Graph 6. Research and application process

As you can see from the process graph above, visualizing information is a complex process. When it comes to describing a thousand word essay with a single visual map, there are necessary techniques that need to be considered by every designer. Data visualization is a strong and powerful medium if it's designed considering the attempted pivot of the story. Therefore, research is an insightful resource for the designers that are supposed to deliver the information quickly and effectively.

7. Conclusion

A data visualization can be used as a tool, helping one to see the details in addition to the big picture. It can be extremely beneficial in the decision making process. Alberto Cairo states that “The purpose of infographics and data visualizations is to enlighten people—not to entertain them, not to sell them products, services, or ideas, but to inform them. It's as simple—and as complicated—as that” (Cairo, pp. 24). This visualization can be updated thanks to the opportunities provided by programming and it is used by experts, especially environmentalists to take action upon highly damaged areas.

My focus on the intersection of time, space, and motion, allowed me carry information design beyond a single surface or medium, investigating the ways to form the work in real space. I believe this immersive approach to information design transforms a communication into an experience. This multi-sensory experiential approach to data presentation takes the abstract into the viewers world. A lasting and ultimately more organic understanding of the issues affecting us will benefit policy makers, implementers, and the public at large. By focusing on a single report about the Syrian War, I aimed to illuminate the impact and consequences of wars and military activities. This visualization shows certain patterns, including the destruction strategies of

industrial sites and critical infrastructure that create long term impact on Syria. A single data table turned into a complex and dynamic infographic guides the viewer. It is possible to apply this tool to other components and data sets in Syria or around the world, which means there is a lot more to do and discuss.

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