Creating a Conference Poster with High-Resolution Network Figures

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Abstract
Creating a poster with high-resolution network images can be a challenging task. In this article, the process of exporting a network figure from a network analysis tool, importing it in a vector graphics tool, and preparing the poster for print is discussed. The steps include critical strategies for producing print-quality figures that also apply to the preparation of network figures for journal publication. We discuss different file formats and argue that the favorite tool for creating conference posters – Microsoft PowerPoint – is not suitable for posters that include network figures. Instead, we suggest the use of Inkscape, a free and open-source tool, or a comparable vector graphics tool to prepare your posters. The goal of this article is to provide a tutorial-like description of the critical steps for creating a conference poster with high-resolution network figures.

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1. Introduction

Visualization is crucial for the development of a scientific field (Crosby, 1998; Freeman, 2000). Network visualizations are great ways to present the results of scientific projects. Much of the attention of research related to network visualization has focused on positioning the nodes in the figure, i.e. the layout of the network (Brandes, Freeman & Wagner, 2013; Eades, 1984). Recently, the focus of interest in the context of network visualization has shifted to using visual elements for mapping multivariate information to network images (Hennig, Brandes, Pfeffer & Mergel, 2012; Krempel, 2005, 2011; Pfeffer, 2017).

However, when it comes to creating a poster with a network figure, these mapping strategies cover only some of the necessary steps. Table 1 shows the entire process of creating a network poster from preprocessing the network data to completion of the poster by the print shop. In this article we discuss the technical details of the points "Export Figure," "Import Network Figure" in a vector graphics tool, and also "Save Poster for Printing." We also offer short comments on "Transfer Poster File to Printer". These crucial steps for creating a poster with a high-resolution network figure are described below. It is important to notice that all of these steps are essential and not optional. We do not discuss general aspects of poster layout, e.g. arranging text and figures; the focus is on the quality of the network figures on the poster.

Most of the strategies discussed here also apply to preparing network figures for print publications. In poster creation, many roads can lead to success (or failure). In the following, several decisions have been made and, for the sake of simplicity, only a few of the possible alternatives are discussed. The goal here is to provide a tutorial text that will work for most scholars irrespective of their current knowledge or experience.

Table 1: Workflow of creating a poster with a network figure. Steps in bold are discussed in this text.

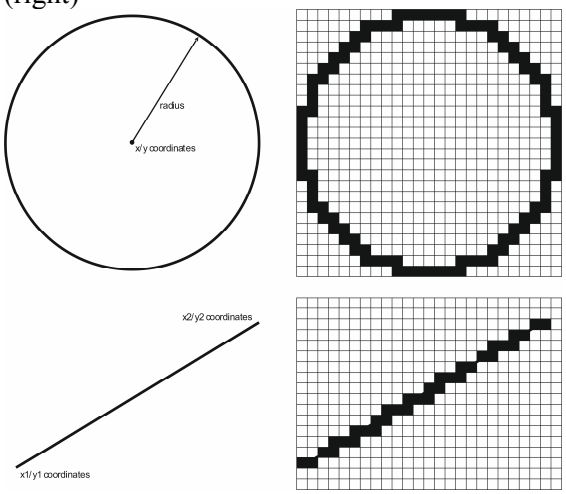
Pre-Processing →	**SNA Tool** →	**Vector Graphics Tool** →	**Poster Printing**
• Prepare Network Data	• Create Layout	• **Import Network Figure**	• **Transfer Poster File**
• Prepare Attributes	• Map Information	• Create Poster	• Print Poster
• Import Data	• **Export Figure**	• **Save Poster for Printing**	• Get Poster to Conference

2. Export Network Figure

The first challenge is to save your network figure in your favorite SNA tool as a *vector graphics file*. In vector graphics, network drawings are stored as polygons. In other words, a circular node is stored with x/y coordinates, as well as with the radius and the color information for filling the circle. A link is stored with both pairs of x/y coordinates of the nodes that this link is connecting. When this file is read and the network is drawn, it literally gets drawn circle by circle and line by line. In contrast, raster format files were developed to store images created from photos. Storing a photo can be imagined as putting a raster over the image and storing information for every cell (pixel) of this raster. While this is a fine approach for storing images from digital cameras, the right-hand images in Figure 1 show the problem that results when storing network figures. Images that may look good on screen can have very poor resolution on a poster,

which will be much larger than the screen. The reason for the pixelated effect is that zooming a raster image merely makes the raster larger. On the other hand, a circle from a vector graphics file gets drawn larger by, literally, drawing a circle with a larger radius and a line stays a line, just with different coordinates. Consequently, you can endlessly zoom in at the vector graphics file without losing any resolution quality.

Figure 1: A network node and a link stored in a vector graphics file (left) and in a raster file (right)



Export as PDF/EPS. There are two very popular file formats for vector graphics: Adobe's PDF (Portable Document Format), and EPS (Encapsulated PostScript). Although there are significant differences between these two file formats, they can be used interchangeably in current software programs. So, the first step in creating a poster with a decent network visualization is to export the network drawing as a PDF or EPS. There are also other file formats that will do the job, e.g. SVG (Scalable Vector Graphics) or even a format for three-dimensional graphics such as VRML (Virtual Reality Modeling Language). NetDraw, the visualization tool of UCINet (Borgatti, Everett, & Freeman, 2002), does not support PDF/EPS. Instead, with NetDraw, it is possible to export a network drawing as a "Metafile," e.g. EMF (Enhanced Metafile) and (WMF) Windows Metafile. The logic of these file formats is similar to PDF/EPS, and most vector graphics tools (see next section) can import them. The decision on which to choose for your preferred file format will depend on positive answers to these three questions: Is the format made for vector graphics?[25] Can my SNA tool export files with this format? Can my graphics tools import files with this format?

If none of the above-mentioned file formats is available in your favorite network tool, then there is one last option: you can use a PDF creator tool, e.g. Adobe Acrobat or PrimoPDF, and *print* the network into a PDF. However, this approach is not always successful when it comes to the next step, described in the following section. Independently from how you extract a vector graphics file from your favorite SNA tool, this step is critical and cannot be bypassed. In other words, you should only use a tool that offers a vector graphics export option. If the tool you've selected does not offer that, you should not use it. Or, you could call upon the authors of the tool to add this feature!

Never use JPG. There is one file format that should never be used for exporting network figures: JPG or JPEG, an acronym for Joint Photographic Experts Group, a committee that created this standard. JPG files are often used for photos from cameras or phones because they compress the image data before storing it. The compression works well enough for photos because the human eye does not need to distinguish among a vast number of shades of blue to recognize the sky in a photo. But with network drawings, the JPG data compression has tremendous ill effects on the quality of the figure. The most obvious distortion is that blurry areas will be drawn around lines as the JPG compression algorithm tries to interpolate a gray area between the black line and the white background.

PNG can be not so bad. If you are stuck with a tool that has no vector-

[25] To answer this question, Google and Wikipedia can help.

graphics export option, you should export your network figure as PNG (Portable Network Graphics). Don't be confused by the word *network*; PNG is a raster file format and therefore not preferable for network drawings. However, the PNG is a *lossless* compression format, so that the blurry areas of the JPG can be avoided. The pixel effect from zooming (see Figure 1) is still an issue for PNG. This can be (in part) overcome by creating the PNG with high resolution – if the SNA tool offers this option. Raster graphics resolution is described in dpi (dots per inch). The human eye needs about 300 dpi in order not to see the actual pixels. This means that a 1 x 1 inch area on paper should have 300 x 300 = 90000 pixels. When you use an image with 300 dpi for your poster and you re-size it to 500% to better fit your poster space, the area of pixels in the raster gets five times larger, resulting in an image with 134 dpi. At this resolution humans can easily discern pixels, and this reduces the visual quality of the network drawing on a poster. Consequently, 600 or even 1,200 dpi should be used – but this will create huge files. In a nutshell, then, while PNG files can create decent network images, vector graphics files will always have better resolution and will look better on your poster.

3. Graphics Tools

Here is the bad news. You cannot use PowerPoint (or its freely available emulations) for creating your poster because these tools cannot handle vector graphics files. Instead, we need to turn to tools that are optimized for vector graphics file formats. Adobe Illustrator is a widely used (but costly) tool for this purpose. However, there are freely available alternatives to Illustrator. For the purposes of this article we use *Inkscape,*[26] as it is freely available for Windows, Mac, and Linux. An easy test for whether a tool qualifies for our purpose is to import the vector graphics file that you have extracted as described above, and zoom in as far as possible on a single node. If you can still see a nicely drawn circle, then this tool can handle vector graphic files. If you see pixels similar to the right-hand images of Figure 1, then this tool does not qualify for the task of creating a poster with a high-resolution network image.

To bring into Inkscape a network drawing that is stored in a vector graphics file, select *File/Import* and import the network to your open poster document. Now, zoom in thousands of percentages to double-check the correct transfer of your vector graphics-based network image. When you zoom out again and click on the network, you will see that the imported network is an object that can be moved around and changed in size. If you change the size make sure to hold the *Ctrl* key while doing that so as to preserve the height/width ratio of the image. Inkscape is very intuitive and many tutorials can be found online that will help you to add the additional text, logo, and other visual elements needed for your poster.

Handling accented characters. When you have finished your poster layout, make sure that you save it as a PDF as this is the preferred file format of poster print shops. There is one more trick that is especially important if your poster contains special fonts or non-English characters. If you select all objects of your poster (press Ctrl-a) and then select *Path/Object to Path* in the menu, then all text will also be transformed to paths, i.e. vector graphics objects. Consequently, the poster printer can print your poster even if the language or font is not installed on the printer's computer. Without this step, the print process could change your font and replace some characters with interesting-looking special characters. Transforming fonts to paths should be the very last step before storing the poster as a PDF for the print shop. Be aware that you cannot change any text after this transformation step.

[26] Download and tutorial: https://www.inkscape.org/

4. Poster Printing

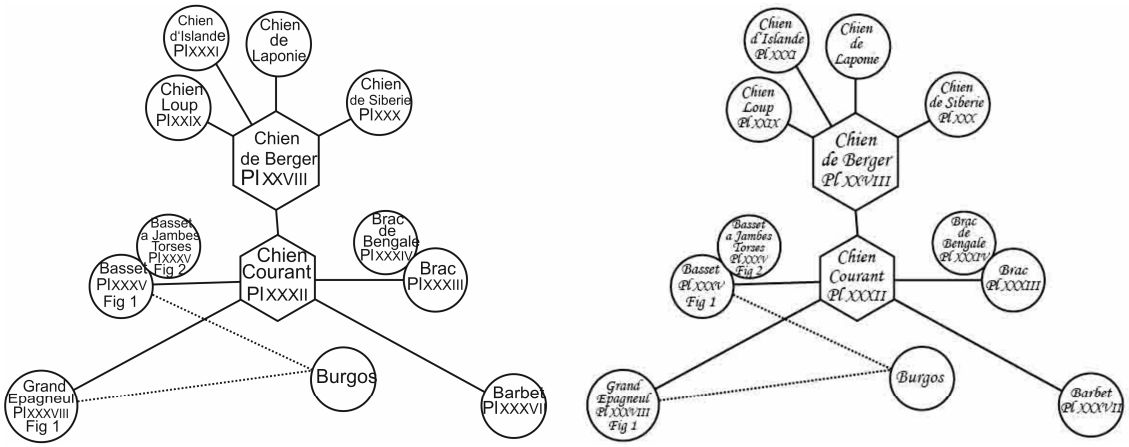
The process of actually printing the poster is straightforward if you have created a PDF in a similar way to the process described above. Here are some additional comments that should make your life easier and your poster more attractive:

- Before starting to work on your poster, go to the conference website and figure out the size of the poster boards as well as whether the posters should be in portrait or landscape orientation.
- Spend the extra few bucks and go for the gloss paper – you will love it. In any case, try to avoid very thin (light) paper.
- If the poster session is not during the first evening of the conference, think about printing the poster close to the conference venue. For instance, in the United States most FedEx shops print posters. Call a week before the conference and double-check that a) the print shop actually exists, b) it is at the place that Google tells you, and c) the person doing the prints will accept print orders via email or file download.
- Good-quality posters can result in large PDF files. If your file is larger than 5MB, use a file transfer service, e.g. https://www.wetransfer.com/
- Get a poster tube for transporting your poster – yes, these tubes can be part of your cabin luggage, no check-in necessary. But don't let the poster sit in that tube for two weeks or it will become hard to unroll.

5. An Example

To illustrate the significant differences between a vector graphics file and a raster format file we use a partial reproduction of a very old network visualization. In an effort to create an encyclopedia of the natural sciences, Georges-Louis Leclerc, Comte de Buffon, visualized dog breeds and their relationships (Buffon, 1755; Mayer, 2013). The left-hand image in Figure 2 was created along the lines of the process described above. The result is a clearly printed high-resolution image that could also be printed in any size on a poster. The right-hand side is a low-resolution JPG file that was enlarged for printing. One can easily see the effects described above: blurry lines and text as well as pixelation. This example also shows that the above-mentioned process is important for network figures in journal articles.

Figure 2: Partial reconstruction of Buffon's dog breeds and their relationships; comparison of printing quality of vector graphics file (left) and raster file (right).



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