Visualizing Input-Output Data Using VUE:
Instructions and Software Guide

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ABSTRACT

This project extends the capability of Tufts University's Visual Understanding Environment (VUE) by allowing users to explore quantitative input-output relationships.

- VUE is "a flexible visual environment for structuring, presenting, and sharing digital information." It allows users to draw concept maps and illustrate relationships using a "visual grammar" of nodes and links.

- Input-output analysis is a widely used economic tool for showing the flow of resources between industries. This tool has a long history in national economic planning and a lively body of current work in environmental and resource economics. Commonly, input-output data are presented in "use" tables, where the rows show source commodities, the columns show destination industries, and the table industries show resource flows in dollars. The U.S. Department of Commerce Bureau of Economic Analysis (BEA) publishes annual data on sales of commodities used by industries in input-output tables.
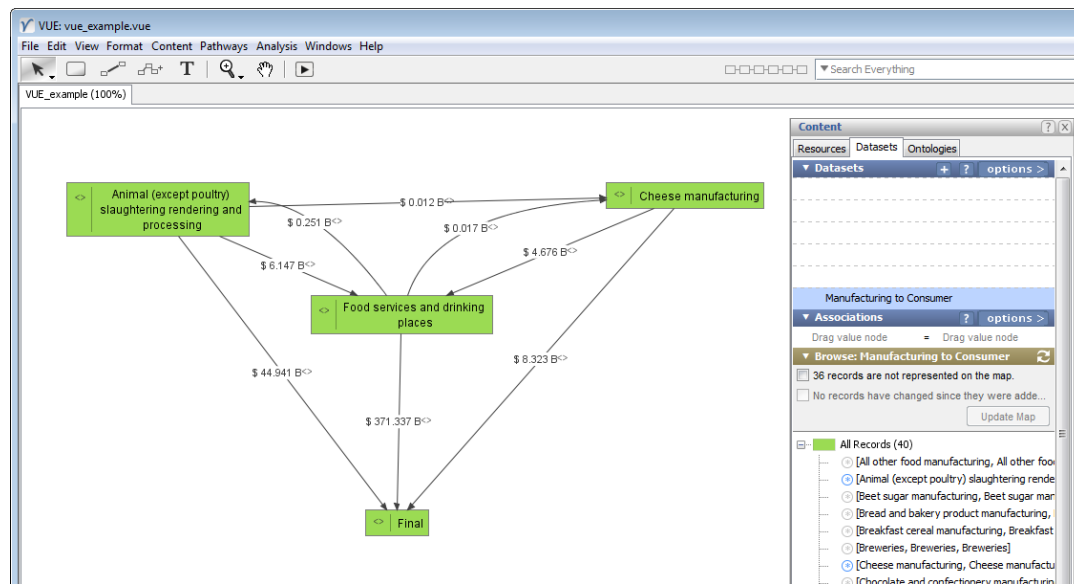
The project allows users to import input-output data into VUE, automatically labeling links with the quantitative resource flows between industries. Users select industries and drag them into a workspace. VUE draws the links between industries and labels them with the corresponding resource flows. This capability makes apparent important inter-industry relationships that were more difficult to see in tabular form.

This document explains VUE's new input-output capability, using resource flows across agriculture and food industries as a running example.

Visualizing Input-Output Data Using VUE

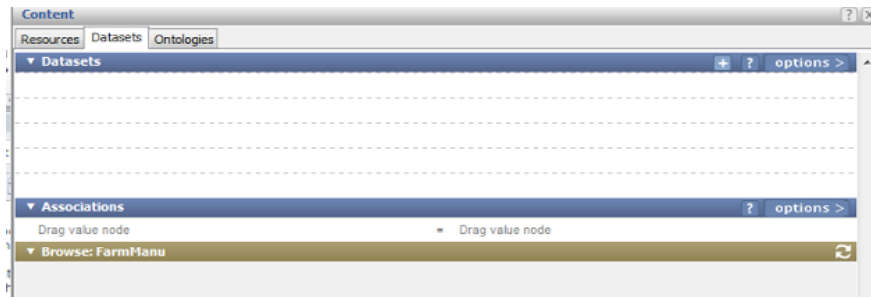**Quick Start Instructions (to open an existing VUE project file)**

1   Open VUE. From the **File** menu, open a VUE project with extension .vue. *In this example, we open the file VUE_example.vue.*

2   In the **Content** window, choose **Datasets**. Select a dataset. *In this example, we open the dataset "Manufacturing to Consumer".*

3   Select "+" next to **All Records** to view your industry choices. You can now drag and drop industries into the map. If there is a positive (non-zero) resource flow between two industries, a label appears showing the resource flow in billions of dollars.
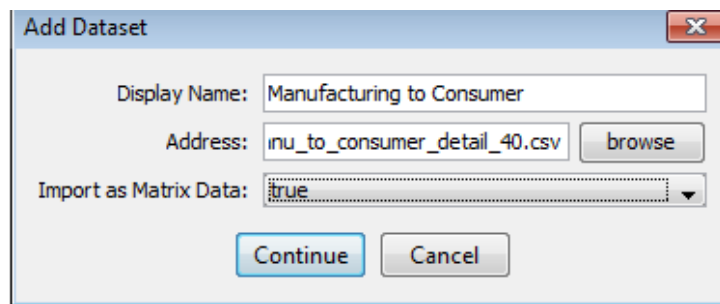
Full Instructions (to begin a VUE project)

To prepare a comma-delimited data file, see the Appendix, or begin with one of the ready-made data files that accompany this instructions document.
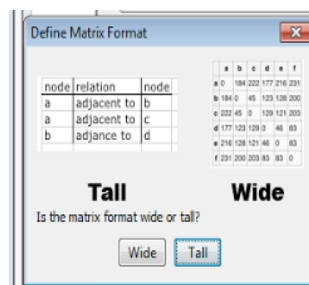
1 Download and install the VUE application from the Tufts University website: http://vue.tufts.edu/. VUE is available for PC or Mac. These instructions were tested with VUE version 3.1.2.
2 Open VUE.
3 From the **Windows** drop-down menu, choose **Contents**.
4 Select the **Datasets** tab and select "**+**" to add a dataset.
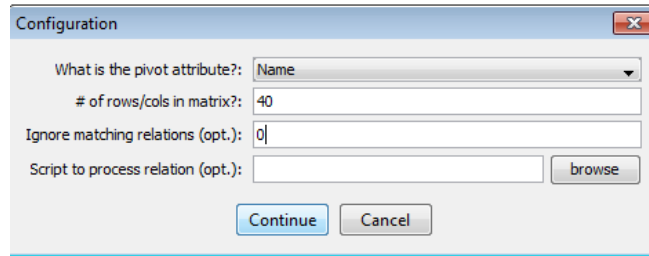

5 In the **Add Dataset** dialogue box:
   a Create a **Display Name** for your dataset that provides a short description of the data. *In our example, we type in the display name Manufacturing to Consumer.*
   b Select **Browse** to choose a comma-delimited dataset. *In our example, we choose manu_to_consumer_detail_40.csv (this sample data file accompanies these instructions).*
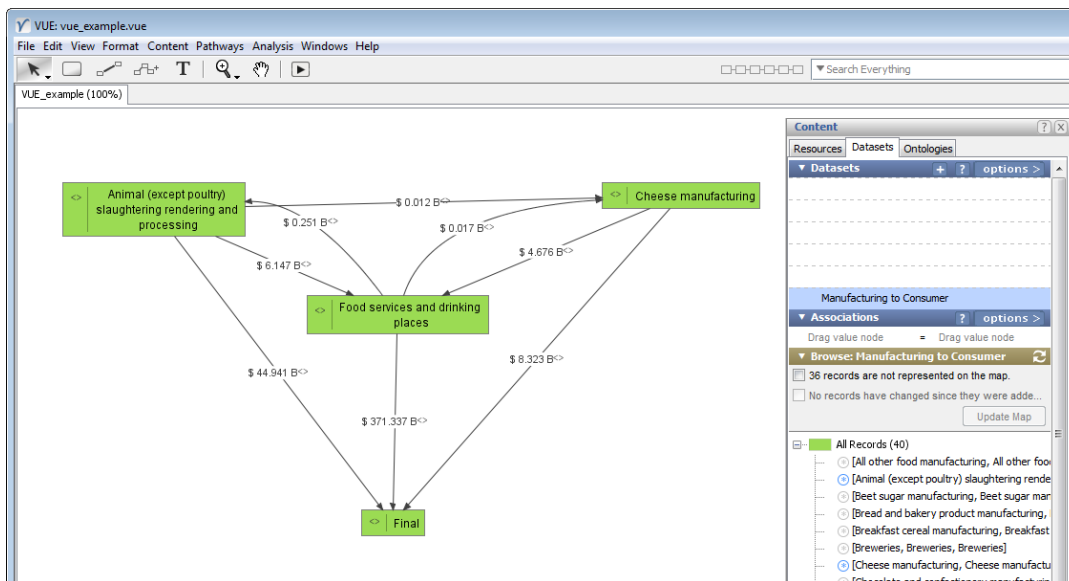   c Under **Import as Matrix Data**, choose **true**.
   d Click **Continue**.

6 In the **Define Matrix Format** dialogue box, choose **wide**.

7   In the **Configuration** dialogue box:
    a   Leave the **pivot attribute** as **Name** (already selected).
    b   Enter the **# of rows/cols in matrix**. We follow a simple convention of including this important information as part of the file name for each dataset. *In our example, we enter **40** rows/cols.*
    c   **Optional:** enter **0 (zero)** into the dialogue box **ignore matching relations (opt.).** This will get rid of connections between industries that have zero value.
    d   Leave everything else blank and select **Continue**.

8   A **Content** window appears. Select "+" next to All Records to view your industry choices.
9   An **Empty Map** appears behind the Content window. You can now drag and drop industries into the map. If there is a positive (non-zero) resource flow between two industries, a label appears showing the resource flow in billions of dollars.

Tips

- Focus on just a few industries with large resource flows.
- Adjust color schemes and line styles using the **Formatting Palette** toolbar.
- To make the map easier to read, right-click on links to delete links for which the resource flow is missing or labeled "$0.00B."
- Adjust the curvature/bend of the links connecting industry nodes by highlighting the links and dragging them by the blue dot. If the link is a straight line with no blue dot for dragging, then right-click on the link to pull up an option for a curved link
- To save, choose **File** in the menu bar and select **Save**. Your map project will be saved for future use. You do not need to upload your data again.
- To create a map for presentation or printing, choose **File** in the menu bar and select **Print Visible**.

APPENDIX 1: Dataset Description

Three sample datasets are provided to show how VUE can be used to visualize inter-industry resource flows in the food and agriculture sector. The contents of the sample datasets are as follows.

Food_system_detail_82.csv contains the BEA's most detailed input-output information for food and agriculture related enterprises. The dataset spans from farm production types to manufacturing, processing, and food service. The "82" indicates that there are 82 industries to be imported into VUE.

Manu_to_consumer_detail_40.csv also provides BEA's detail-level data. The dataset focuses on industries involved with food manufacturing, processing, and retail.

Farm_to_consumer_summary_22.csv contains industry data at the summary-level of aggregation, capturing general relationships between industry sectors. The scope of data ranges from categories of farm production to food service.

MeatCheeseExample_8.csv provides the data used to demonstrate the VUE platform in the video related to this document.

APPENDIX 2: Instructions for Downloading and Formatting Data

To create your own dataset, you may download data from the Bureau of Economic Analysis (BEA) website. Accompanying these instructions, we provide a custom-made Python script to format the BEA download as a comma-delimited dataset for use in VUE. The illustrations in this appendix show how to run the Python scripts on a computer running Apple OSX or Windows 7.
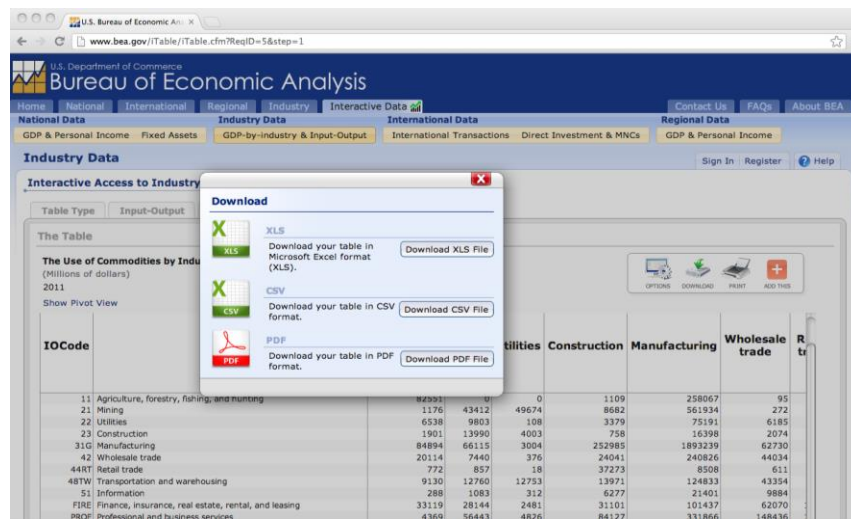
Downloading data from the BEA website
- The BEA website is: http://www.bea.gov/iTable/iTable.cfm?ReqID=5&step=1
  - Under 'table type', select input-output accounts
  - Under 'input-output', select 'use table' and then select 'The Use of Commodities by Industries AFTER redefinitions (1998 to 2011)'.
  - Under 'level of aggregation', select either sector or summary level depending on the data you seek.
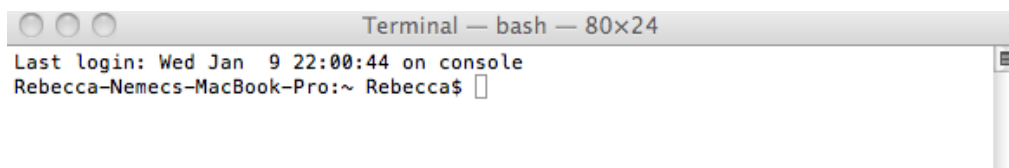
○ Select 'download'.

● Download the table in .CSV format and move it onto your desktop. This Python script in the next step will find the file on your desktop.

Processing date using Python script in Apple OSX
1 Download the Python script to your computer's desktop from the following website: https://bitbucket.org/grahamrjeffries/io/downloads/bea_pro.py
2 Find the Terminal program under 'Applications' (it comes pre-installed with Apple OSX). Open 'Terminal'.

a   Enter the file path name (i.e. the location of the script you downloaded) into this window. In our example, we placed the Python script on the desktop to make it easier to type in the file path name.

b   In the terminal window type in the following while replacing information enclosed by "<>":

Python /users/<nameofcomputer>/desktop/<nameofscript>.py

c   If entered correctly the terminal screen should prompt you to type in the "input file location". If you receive an error message, ensure that your file path name was typed in correctly, as shown above.

d   Type the path name of the data file you downloaded from the BEA website. You will type it in the following form (again note that we specified in early instructions to save this file to your desktop, also be sure to enter quotation marks):

"/users/<nameofcomputer>/desktop/<nameofBEAfile>.csv"

○   Python will process your data. The new processed file will be saved on your desktop and the file name will include "_fmt" at the end (i.e. nameofBEAfile_fmt.csv instead of nameofBEAfile.csv).

○   Here is a screenshot showing the correct use of the Python script.

○   When complete, you may use the dataset in VUE following the "Full Instructions" on page 3 above.

Processing date using Python script on Windows 7

1   Download the Python script to your computer's desktop from the following website: https://bitbucket.org/grahamrjeffries/io/downloads/bea_pro.py

2   Download Python 2.6 here: http://www.Python.org/ftp/Python/2.6/Python-2.6.msi

3   Install Python 2.6. You can accept the default settings.

4   Find the Command Prompt application in the menu under "Accessories."

a   First you must direct the command line to and folder where Python is installed. If you have installed Python in the standard location, simply type:
        cd C:/Python26/

b   Next, we launch the Python program to format our data. In our example, we placed the Python script on the desktop to make it easier to type in the file path name. Enter the following while replacing information enclosed by "<>":

Python C:\Users\<nameofcomputer>\Desktop\< nameofscript>.py

c   If entered correctly the terminal screen should prompt you to type in the "input file location". If you receive an error message, ensure that your file path name was typed in correctly, as shown above.

d   Type the path name of the data file you downloaded from the BEA website. You will type it in the following form (again note that we specified in early instructions to save this file to your desktop, also be sure to enter quotation marks):

"C:\users\<nameofcomputer>\Desktop\<nameofBEAfile>.csv"

○   Python will process your data. The new processed file will be saved on your desktop and the file name will include "_fmt" at the end (i.e. nameofBEAfile_fmt.csv instead of nameofBEAfile.csv).

○   Here is a screenshot showing the correct use of the Python script.

```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Windows\system32>cd C:\python26\arcgis10.0\

C:\Python26\ArcGIS10.0>python C:\users\graham\desktop\bea_pro.py
Wed Jan 30 17:19:12 2013 | starting
Wed Jan 30 17:19:12 2013 | input file location: "C:\users\graham\desktop\detail_agriculture.csv"
82
Wed Jan 30 17:20:02 2013 | done

C:\Python26\ArcGIS10.0>_
```

○   When complete, you may use the dataset in VUE following the "Full Instructions" on page 3 above.

Acknowledgments

This visualization was produced by Parke Wilde, Rebecca Nemec, Graham Jeffries, Mike Korcynski, and Jonelle Lonergan. The programming in VUE was done by Mike Korcynski, and the programming in Python was done by Graham Jeffries.

For more visualizations on topics related to U.S. food policy and economics, see the "visualization" tag at Parke Wilde's U.S. Food Policy blog: www.usfoodpolicy.com .