

Cityscapes:

*An Online Discovery Tool for
Urban and Cultural Studies*

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Presentation Overview

- Amherst College & GIS
- Cityscapes
- Reinventing Tokyo
- Imagining Paris
- Image Processing
- Georeferencing
- Google Maps Tiling



Amherst College and GIS

- A liberal-arts college
 - 1600 students, most in residence
 - 1:8 faculty-student ratio



- GIS Education:
 - Interterm Community-Based Course (9 in Jan. 2010, 3 in 2011)
 - Minor use regular in geology classes until last year (a visitor!)
 - Occasional use of Google Earth for classes and projects
 - Heaviest use for research, ~one thesis student a year

Simplifying Geographic Discovery

- Most of our professors feel GIS is too time-consuming for casual use during a semester.
- Some professors do understand the value of thinking geographically.
- Could we provide an easier-to-use mapping app such as this one for Tokyo?

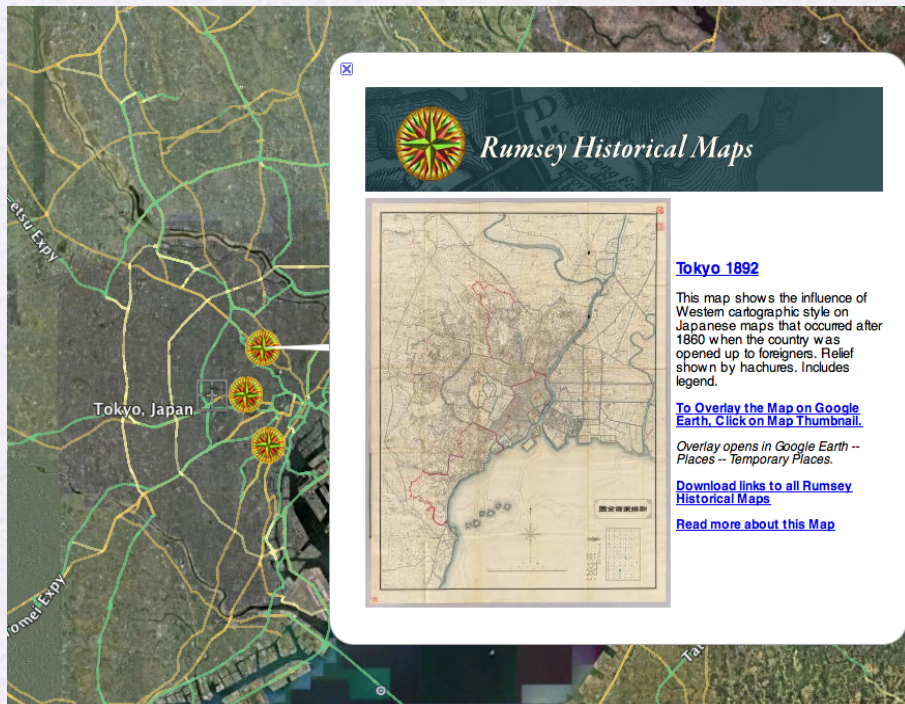


Encyclopedia of Edo-Meiji-Tokyo Digital Map or Superimposed Map (Epipi Company, 2004)

⊕ zooming ⊕ layering ⊖ CD-based ⊖ in Japanese ⊖ ¥¥

Google Tokyo

- Could Google Earth and its Rumsey Historical Maps provide a similar service?
- Students could also use it to build presentations with added content such as images, audio, and video.



- ⊕ zooming
- ⊕ layering+transparency
- ⊕ multimedia balloons
- ⊕ 3D buildings
- ⊕ semi-web-based
- ⊖ semi-georeferenced
- ⊖ HTML formatting

Cityscapes Map Platform

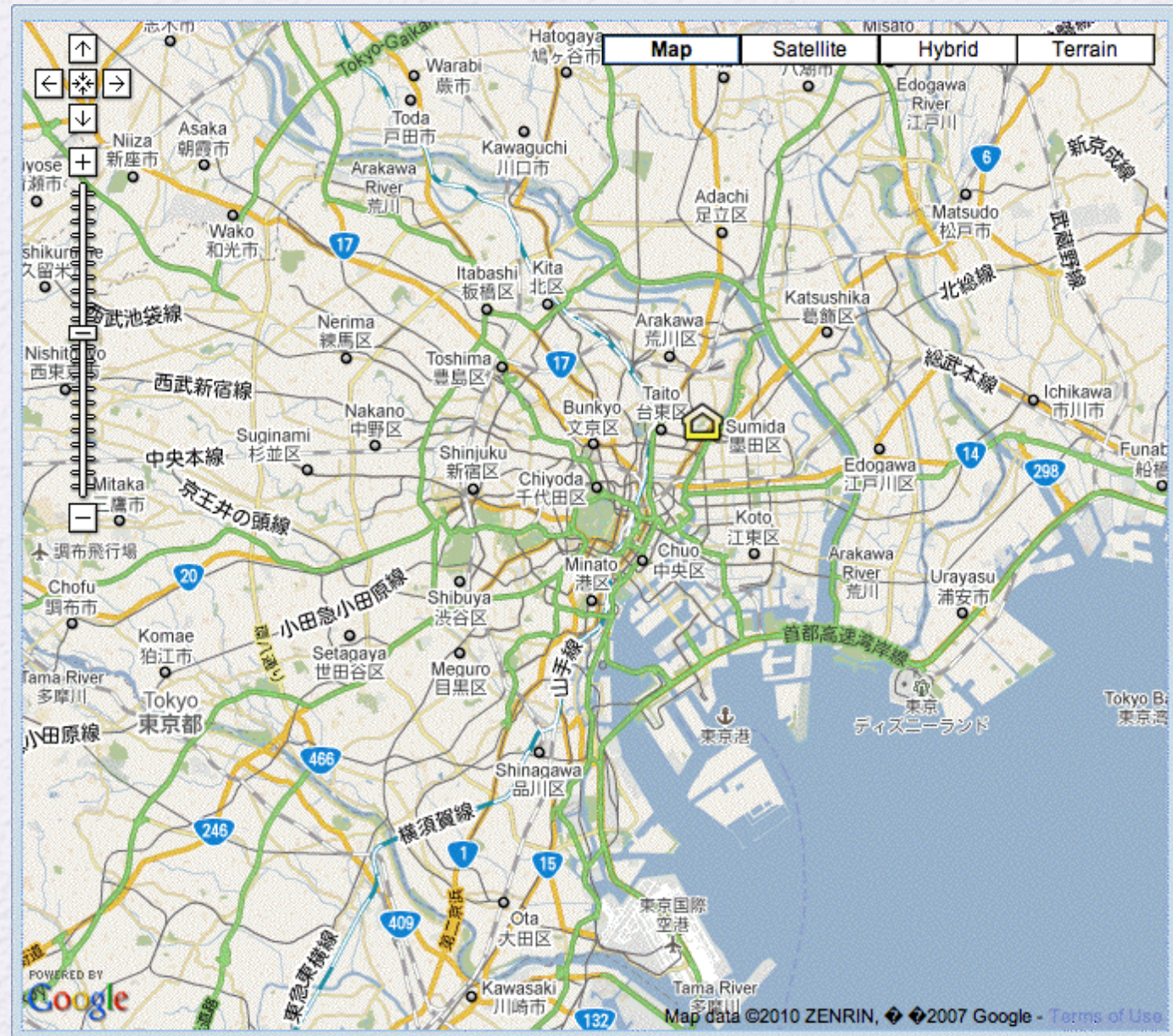
- Google Map Open API:
 - Web-based
 - Zooming
 - Layering
 - Transparency
 - Markers
 - Satellite/Terrain



Cityscapes is Geohistorical

- Allow students to investigate a city over time, e.g. Tokyo:

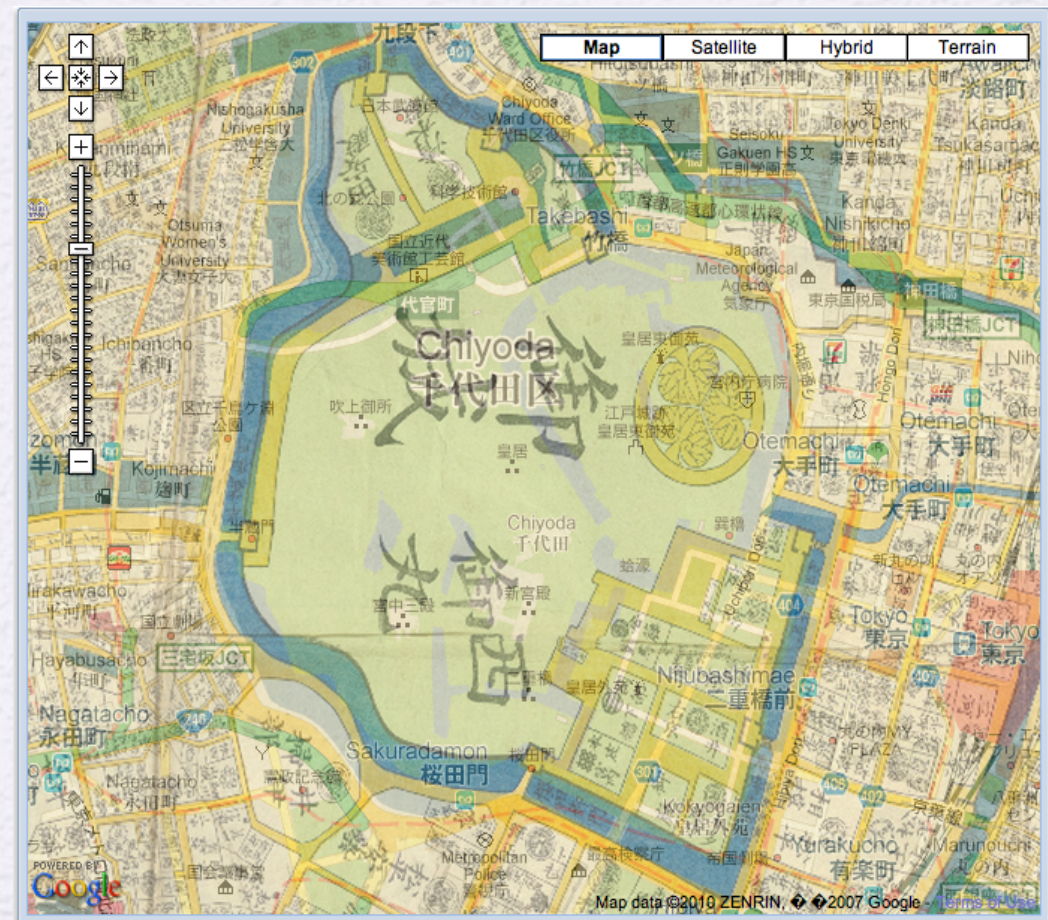
- 1680
- 1799
- 1858
- 1892
- 1945



Cityscapes Historical Maps

- Historical maps are closely georeferenced using ArcGIS
- Google Earth:

Cityscapes:



- Converted to Google format with open source Amherst CTi!

Cityscapes Location Balloons

- Location balloons provide structured media inclusion

Add a New Location

Location Name:

Location Type:

Location Description:

B

I

U

[^]

_v

A

ab

The **Senso-ji Buddhist Temple** is located in the Asakusa neighborhood. It is dedicated to Kannon, the goddess of mercy. Completed in 1645, it is the oldest in Tokyo.

[Image source](#)

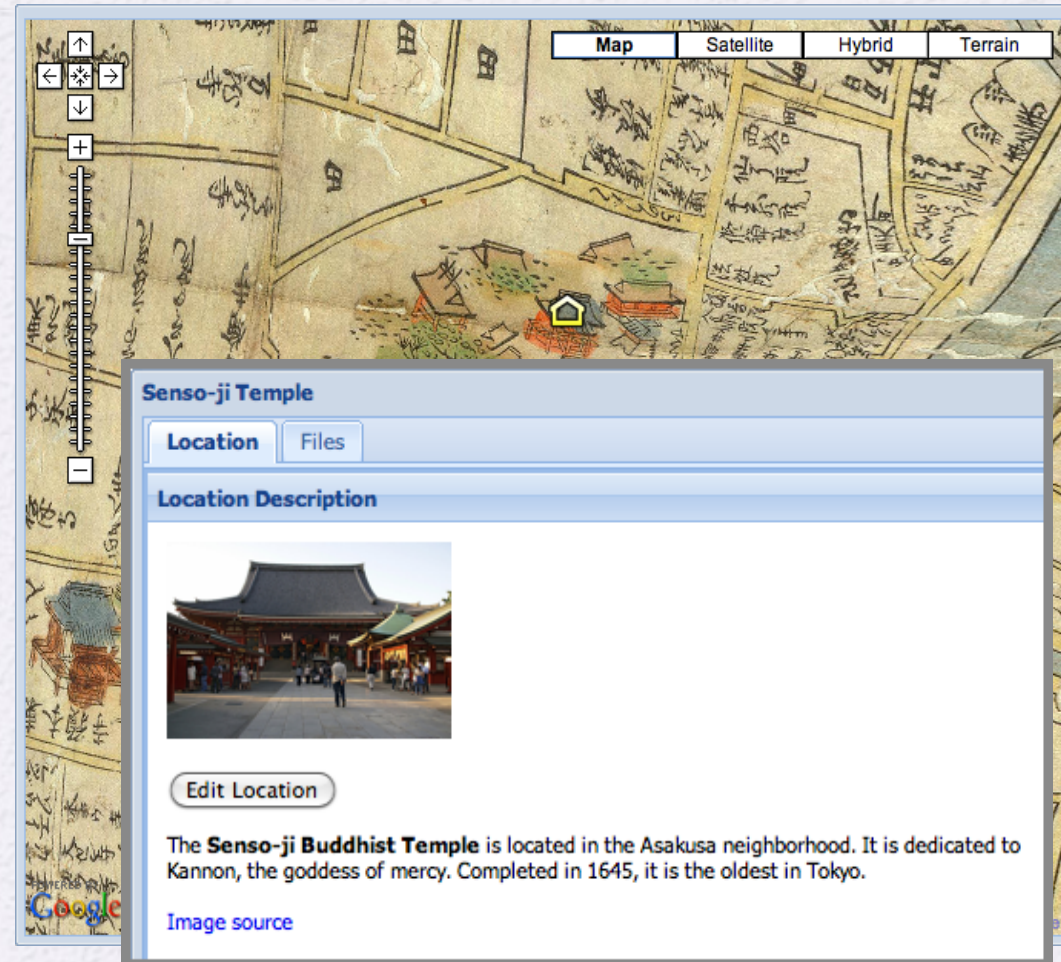
Image File:

Choose File

Asakusa_sen...4s3200.jpg

SUBMIT

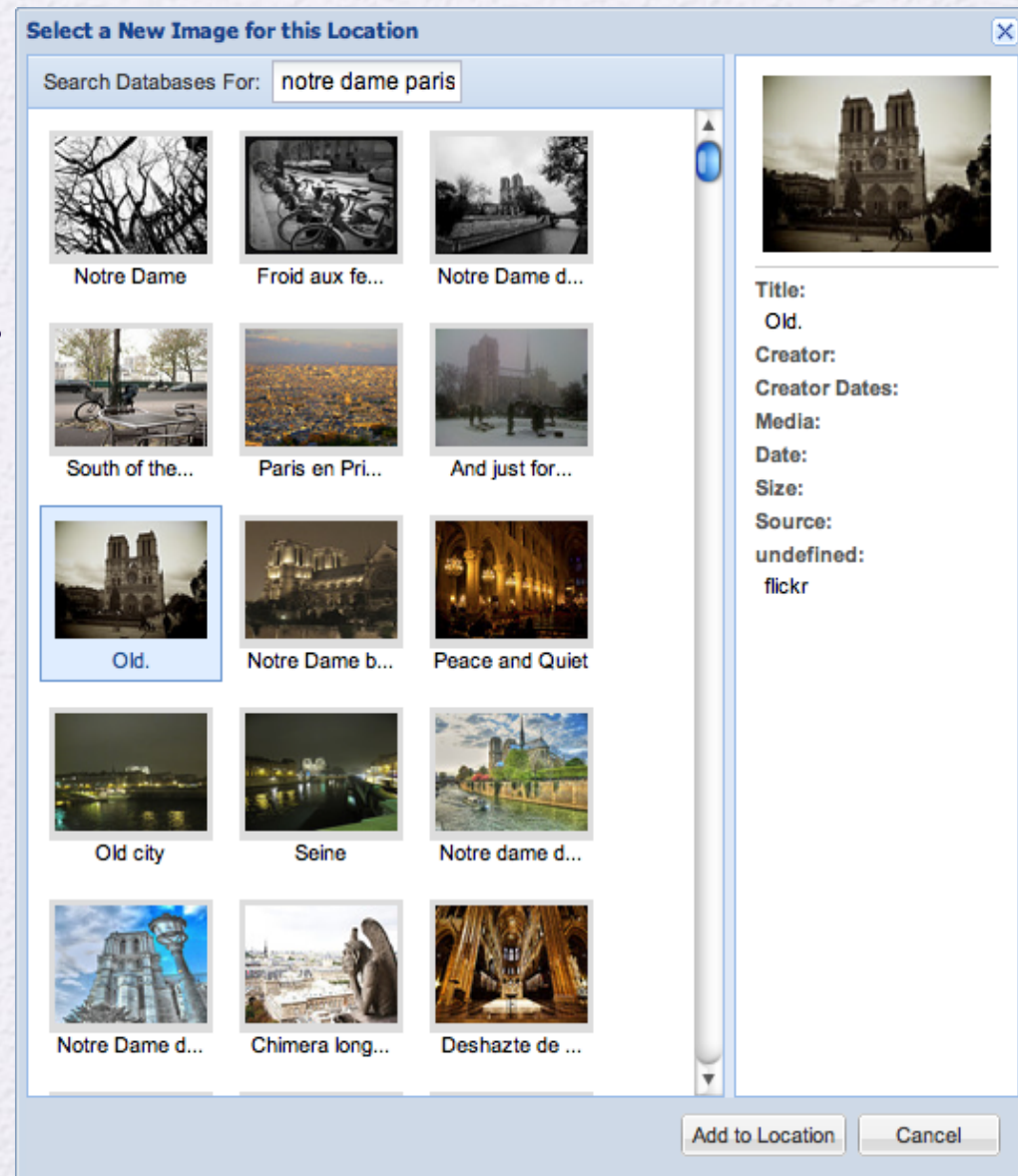
CANCEL



- Dialogues don't require knowledge of HTML.
- Open source: Amherst [aMapApp](#); [Ext JS](#), [PHP](#), and [MySQL](#).

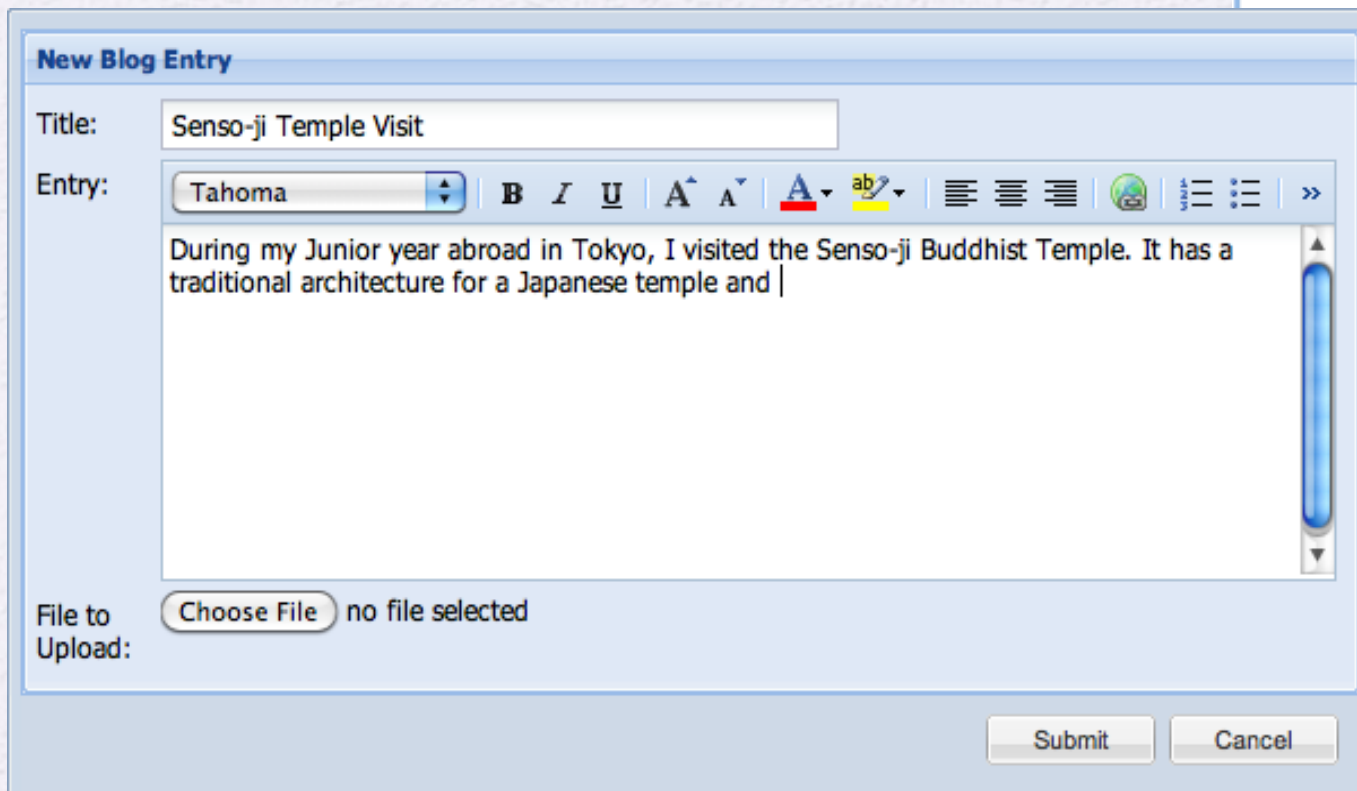
Cityscapes Multimedia

- Location balloons link to an image database using thumbnails, and display them in a dedicated viewer.
- Images can be from different collections:
 - DigiTool (Amherst)
 - Luna (Smith College)
 - Flickr (students & others)



Cityscapes Location Blogging

- Location balloons can have blogs associated with them, letting students converse about the location and included media.



The 'New Blog Entry' dialog box is shown with a light blue border. It contains a 'Title' field with the text 'Senso-ji Temple Visit'. Below it is an 'Entry' field with a text area containing the text 'During my Junior year abroad in Tokyo, I visited the Senso-ji Buddhist Temple. It has a traditional architecture for a Japanese temple and |'. Above the text area is a toolbar with various icons for text formatting (bold, italic, underline, font size, background color, text color, bulleted list, numbered list, indent, link, unlink, image) and a dropdown menu showing 'Tahoma'. At the bottom left, there is a 'File to Upload:' section with a 'Choose File' button and the text 'no file selected'. At the bottom right, there are 'Submit' and 'Cancel' buttons.

New Blog Entry

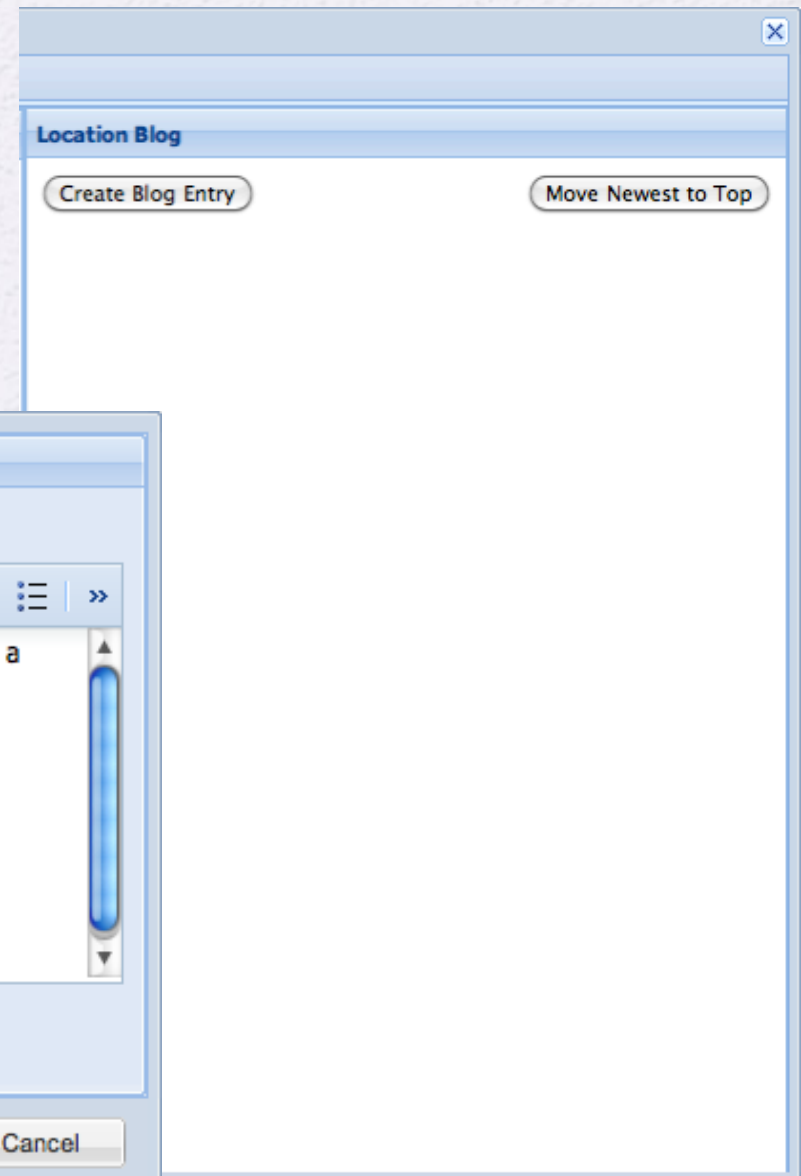
Title: Senso-ji Temple Visit

Entry: Tahoma **B** *I* U A⁺ A⁻ A ▼ ab ▼ [List Icons] [Image Icon] [More Icons] >>

During my Junior year abroad in Tokyo, I visited the Senso-ji Buddhist Temple. It has a traditional architecture for a Japanese temple and |

File to Upload: Choose File no file selected

Submit Cancel



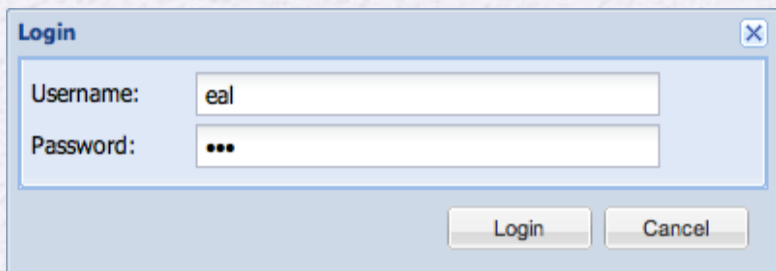
The 'Location Blog' dialog box is shown with a light blue border. It contains two buttons: 'Create Blog Entry' and 'Move Newest to Top'.

Location Blog

Create Blog Entry Move Newest to Top

Cityscapes Access Control

- Privacy of student projects is important.*
- *aMapApp* location balloons are created *outside* of Google maps, so their content is not web-searchable.
- Built-in access control and groups for classes.



A small login dialog box with a title bar labeled 'Login' and a close button. It contains two input fields: 'Username:' with the text 'eal' and 'Password:' with masked characters '***'. At the bottom are 'Login' and 'Cancel' buttons.

aLogin Authentication System Administrator Functions

Add User

Name:
Password:
Re-enter Password:
Authority Level:
Email:

Edit User

Name:

Delete User

Name:

Accept New User Requests

[Go to New User Requests Page](#)

Display All Users

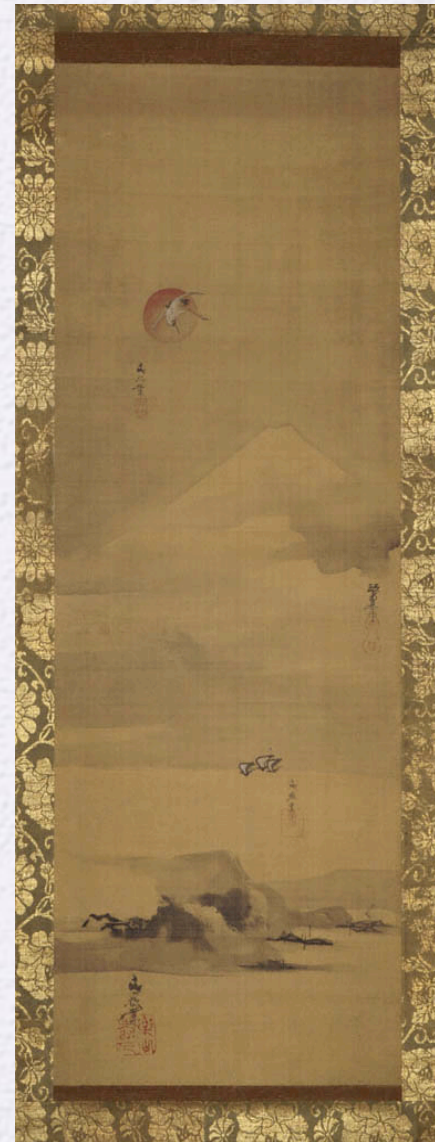
[Go to Display All Users Page](#)

* e.g. Family Educational Rights and Privacy Act (FERPA)

Cityscapes Tokyo

<http://ats.amherst.edu/tokyodemo>

- *Reinventing Tokyo: The Art, Literature, and Politics of Japan's Modern Capital*
- “Tokyo is the political, cultural, and economic center of Japan, the largest urban conglomeration on the planet, holding 35 million people.... Since its founding 400 years ago, when a small fishing village became Edo, the castle headquarters of the Tokugawa shoguns, the city has been reinvented multiple times...”
- Amherst College
Professors Morse, Maxey, Van Compernelle



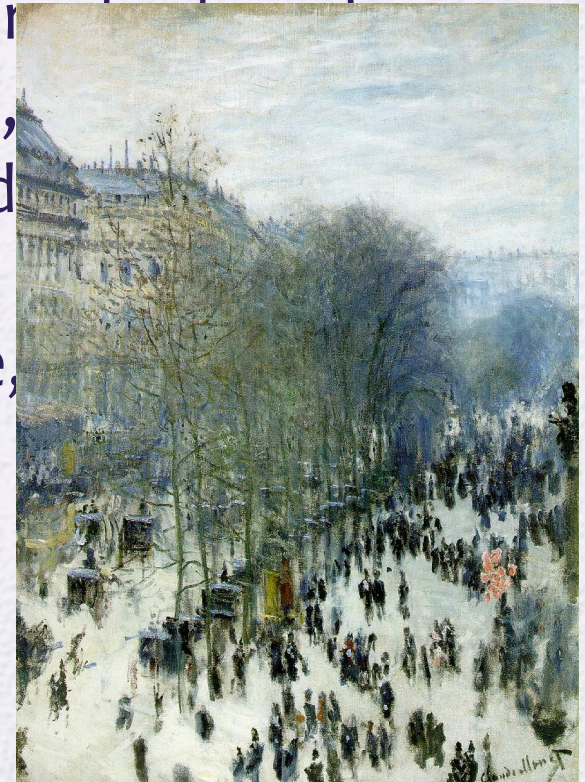
[Fishing Village, Flying Crane, and Mount Fuji](#)

Cityscapes Paris

<http://ats.amherst.edu/parisdemo>

- *Colloquia in French Studies: Paris, a Multi-Layered City*
- “An exploration of the cultural and urban development of Paris across time and in space with an emphasis on the 19th and 20th centuries. We will use an interactive digital platform to reconstruct the spaces, both real and imaginary, from the 19th century in novels, poetry, short stories, popular songs, visual documents, and maps that have evoked the city throughout its history. Works by Corneille, Maupassant, Baudelaire, Apollinaire, Desnos, Modiano, Vargas, Gavalda.”
- Smith College
Professor Visentin

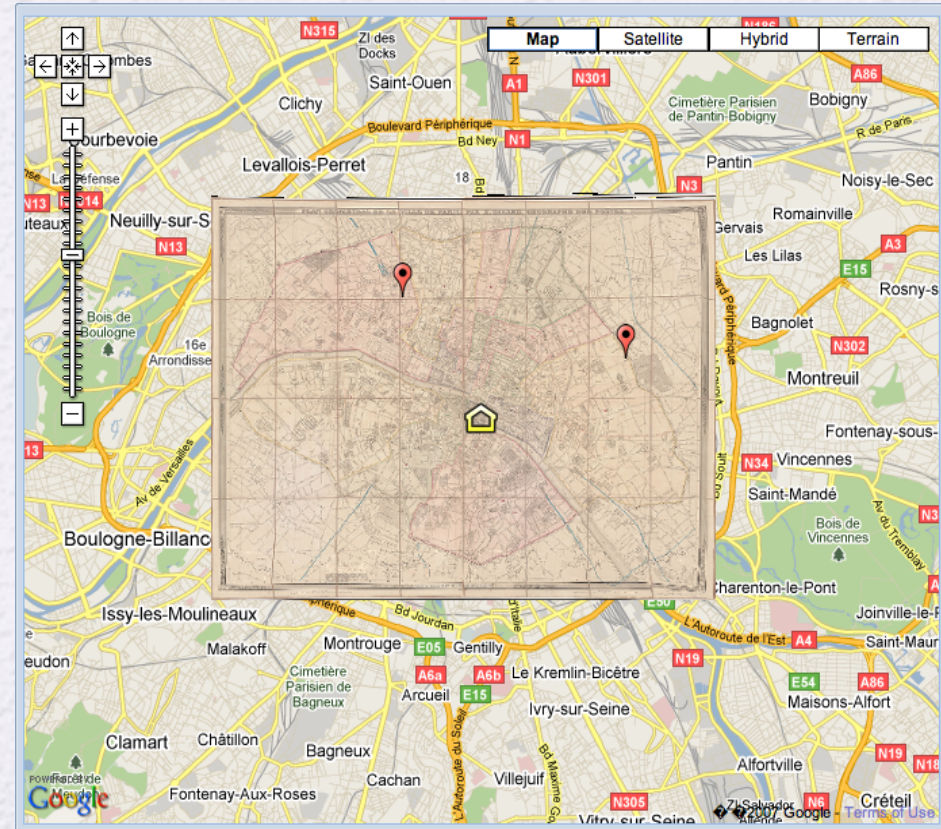
Boulevard des Capucines, Paris
Claude Monet, 1873



Cityscapes Paris

<http://ats.amherst.edu/parisdemo>

- *Pariscape: Imagining Paris in the Twentieth Century*
- “Paris has been for centuries one of the exemplary sites of our urban sensibility, a city that has indelibly and controversially influenced the twentieth-century imagination. Poets, novelists and essayists, painters, photographers and film-makers: all have made use of Paris and its cityscape to examine relationships among technology, literature, city planning, art, social organizations, politics and what we might call the urban imagination.”
- Amherst College
Professor Rosbottom



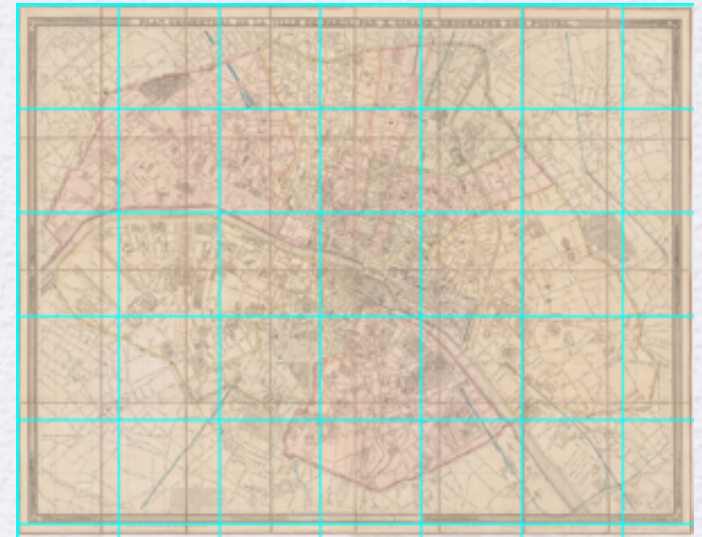
Cityscapes Issues

- Some negatives of the platform:
 - many staff hours
 - occasional bugs
 - no 3D buildings (as of yet)
 - some maps are topologically incorrect (e.g. see the right).
 - many digital images obtained from other libraries, who sometimes claim copyright — getting permission to open to the public is problematic.



Map Image Processing

- Images were downloaded at the highest available resolution.
- Typically images were limited to disjoint pieces ~ 2048 pixels², e.g.:

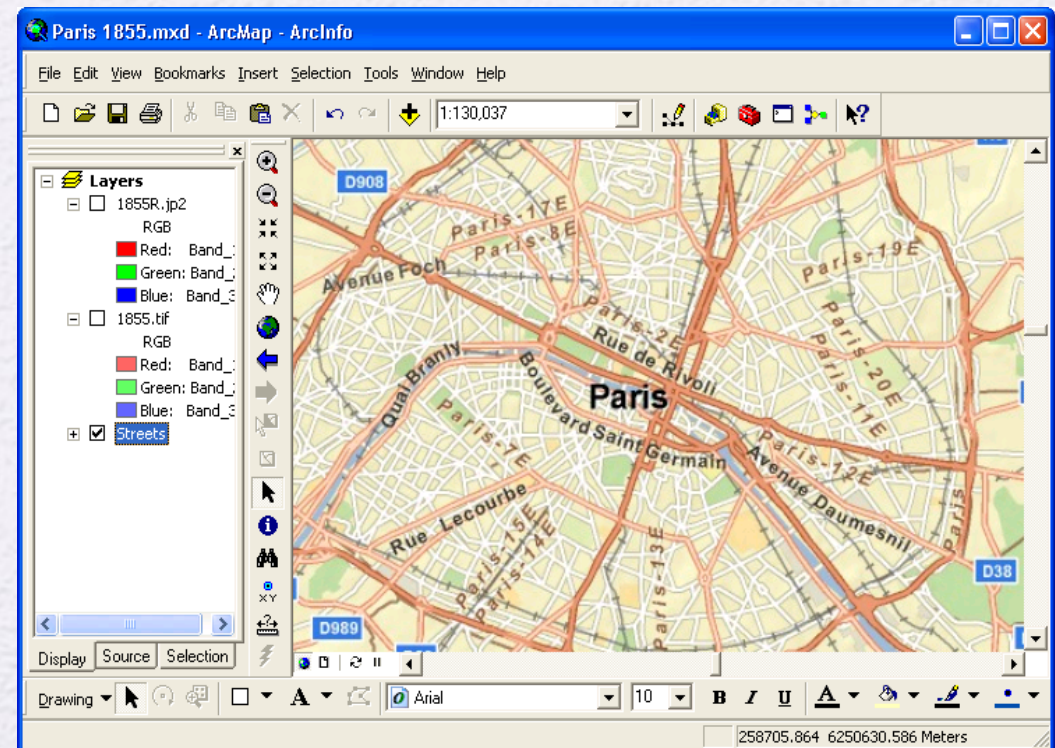


<http://ids.lib.harvard.edu/ids/view/Converter?id=7157748&c=jpgnocap&s=1&r=0&x=0&y=0&w=2400&h=2400>

- These needed to be stitched together with Photoshop, etc., and trimmed of unnecessary margins.
- The resulting maps were usually on the order of 10K pixels², with a scale of 1-2 meters per pixel.

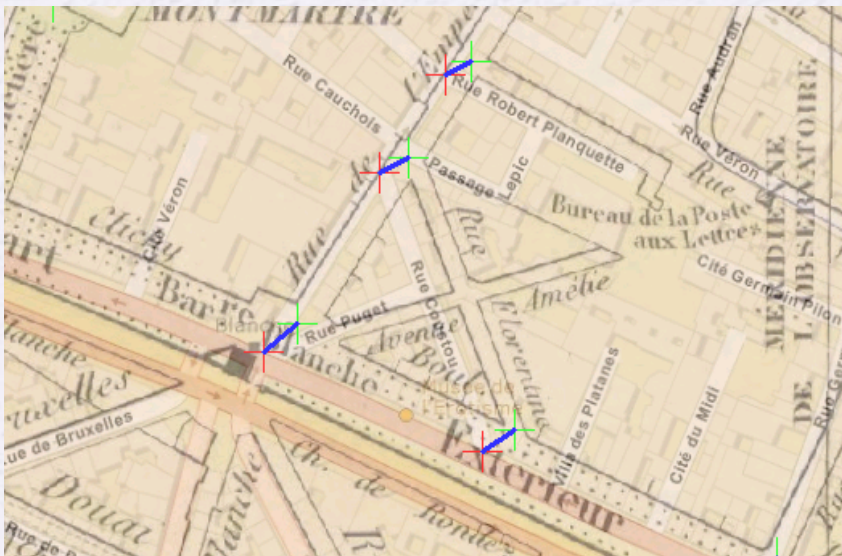
Georeferencing with ArcGIS

- ArcGIS is a very convenient platform for georeferencing images to a map background.
- Best to use the projection WGS84 Web Mercator (Auxiliary Sphere) to georeference, since that's what Google uses. Don't use "Google Mercator"!
- As a background, the ArcGIS Map Service World Street Map had great performance.

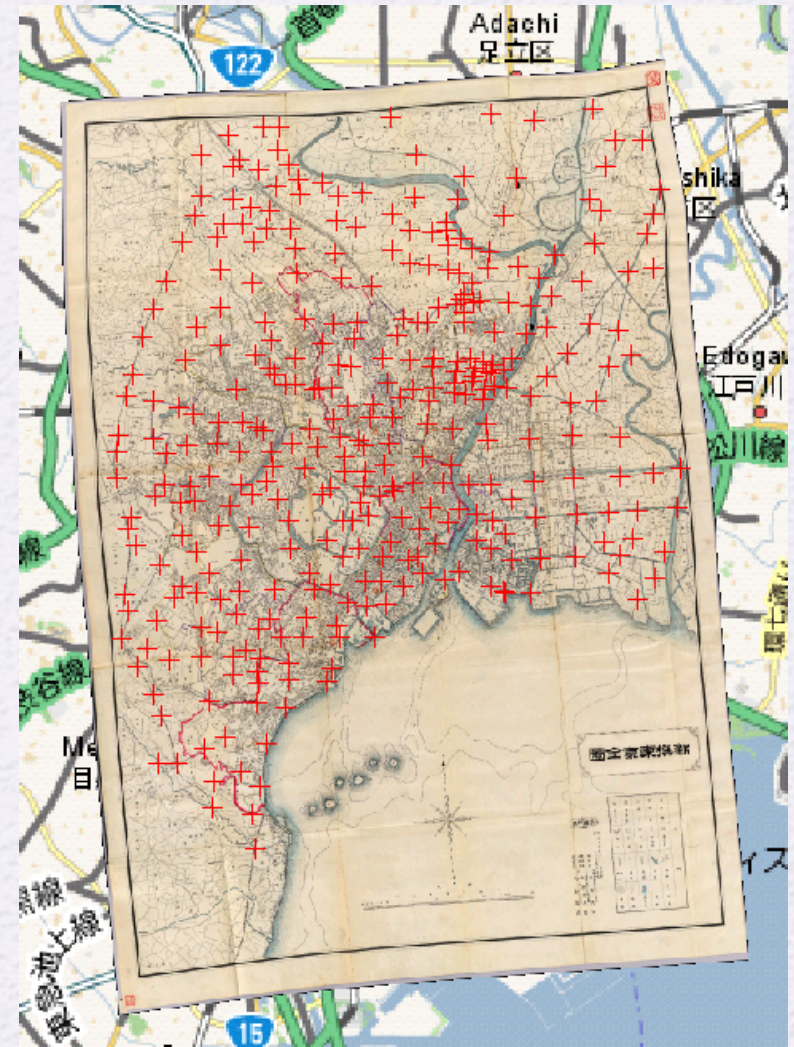


Georeferencing: Control Points

- Control points align two maps at locations that are recognizable on both:

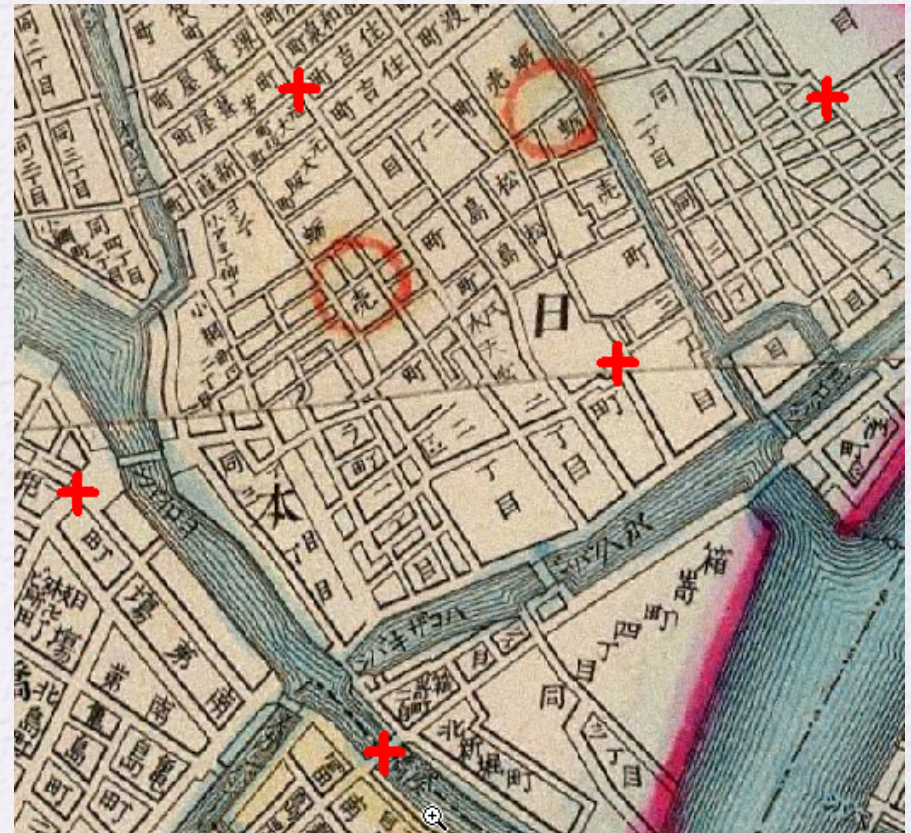


- The Cityscapes maps varied from having many hundreds to several thousands of control points!



Georeferencing: Link Choice

- Streets are recognized by their pattern of connections, so intersections are by far the most important locations to add control points.
 - Not all intersections necessary, if they're close enough.
 - Urban areas require more control points to help distinguish adjacent streets.
- Intersections with railroads, rivers, streams, and canals can also be used.



Georeferencing: Cautions

- Seldom will streets on two maps completely align; if the difference is small or extreme, leave as-is.
- Streets, railroads, and rivers can all change over time!
 - Streets are often built and rerouted; rivers meander.
- Deliberate abstractions are common!
 - Roads and railroads on a printed map are often widened to be distinguishable, which can “bump” other features.



Google Tiles

- Google tiles are square and $256 = 2^8$ pixels across.

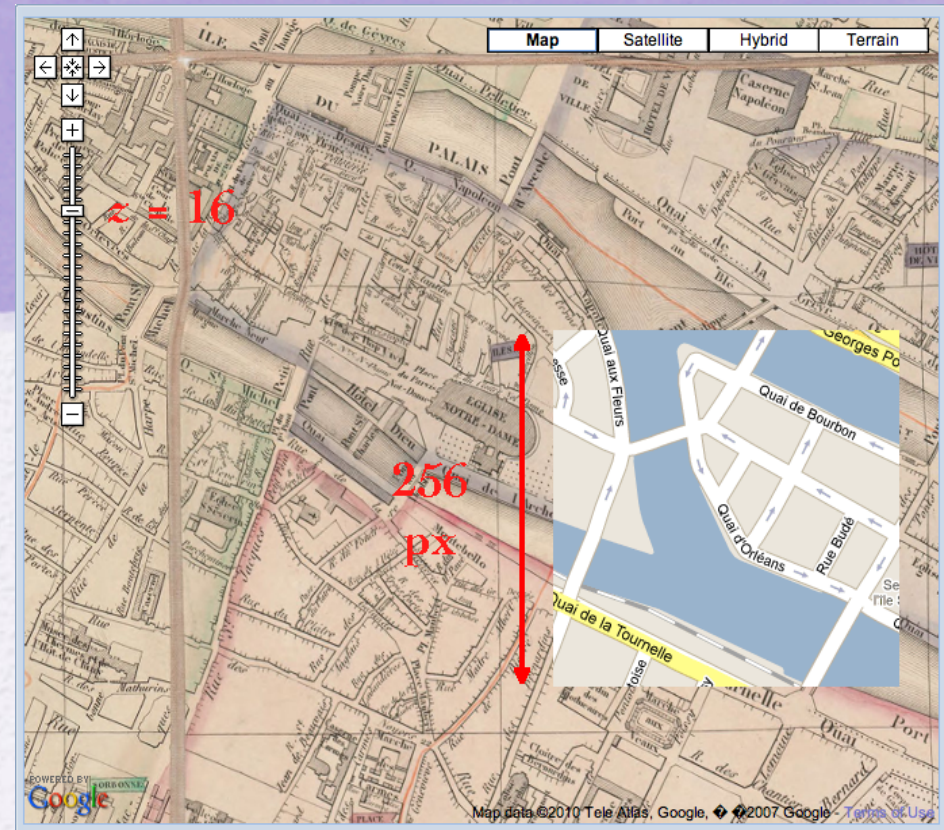
- The Mercator pixel size is:

$$\text{cellSize}(z) = 2\pi r / 2^{z+8}$$

where $r = 6378137$ m is the

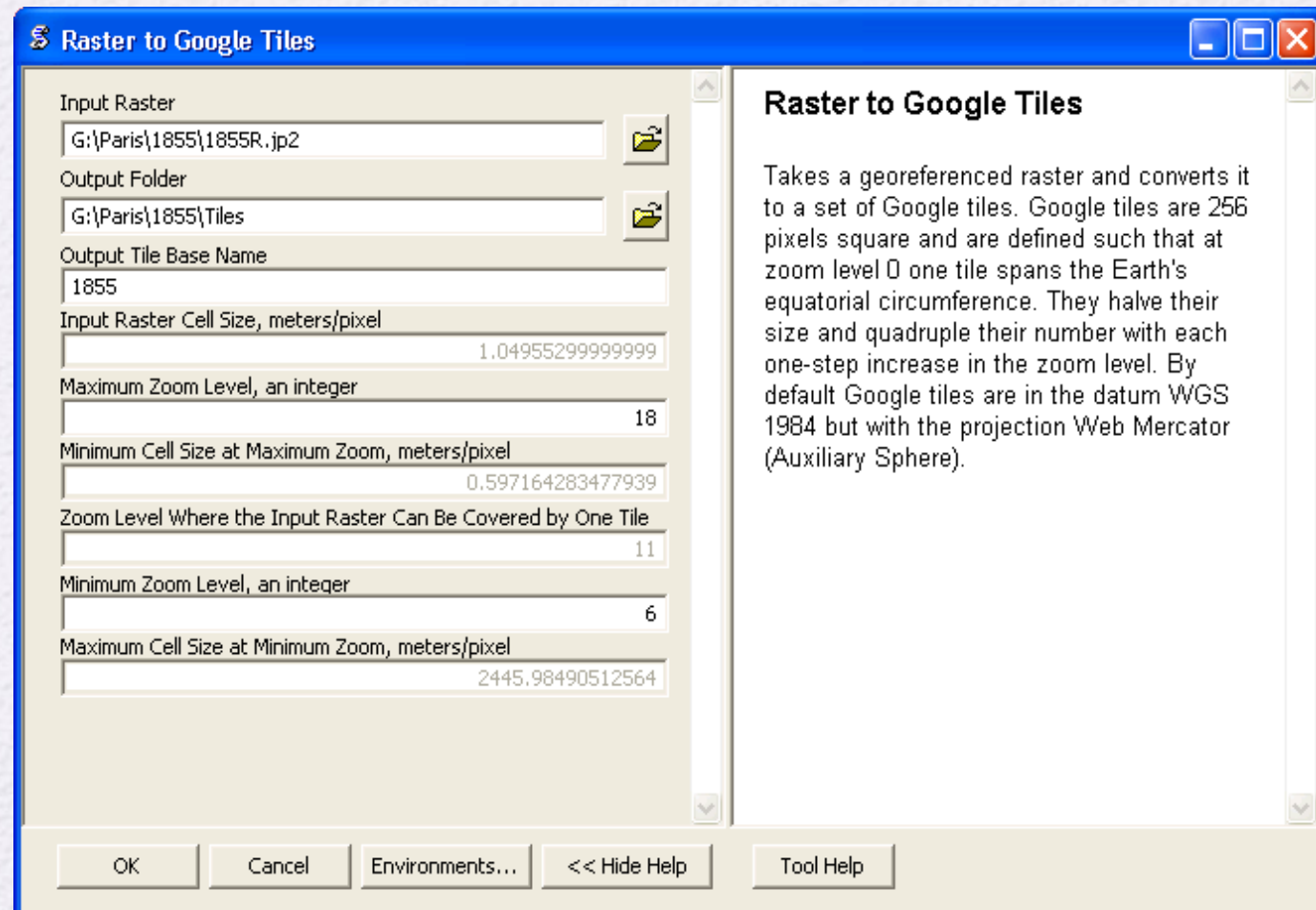
equatorial radius, and z is the Google zoom level.

- By definition, $z = 0$ produces a single tile covering the Earth exclusive of the polar regions (a distance of $2\pi r$).
- Incrementing the zoom level doubles the number of tiles.
- The zoom levels for large cities like Tokyo or Paris range from about 17 (1.2 m/px) to 7 (1.2 Km/px).



GTiler Script

- Tiling a georeferenced and rescaled image can be effected with programs such as Photoshop, etc.
- But, to automate the process, I wrote a Python script.

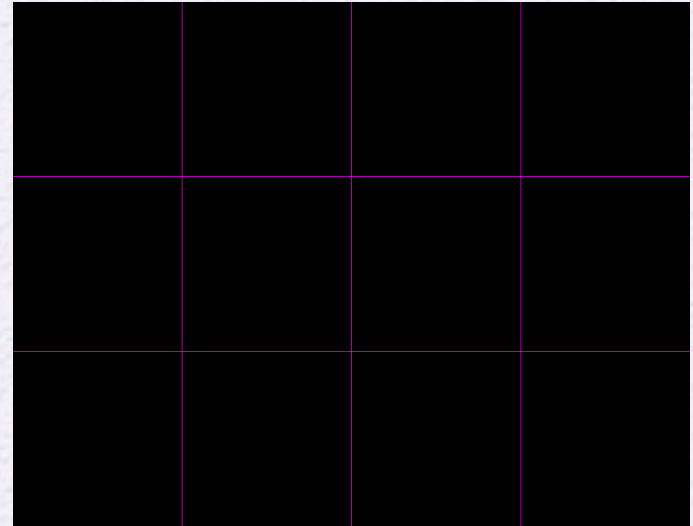


GTiler Procedure

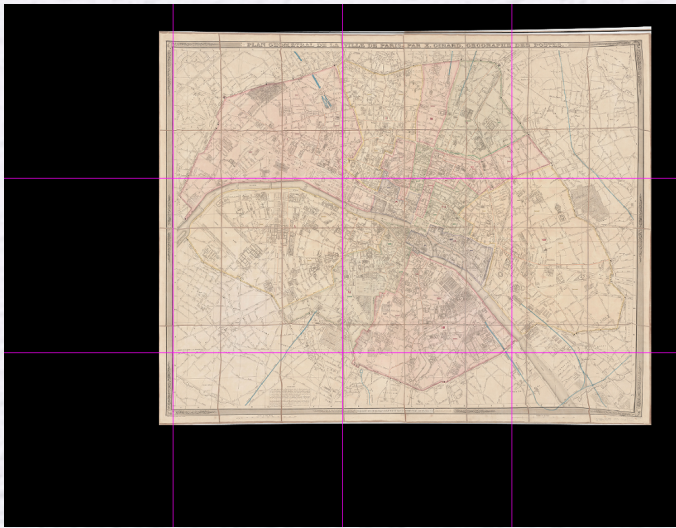
- 1. User-georeferenced map:



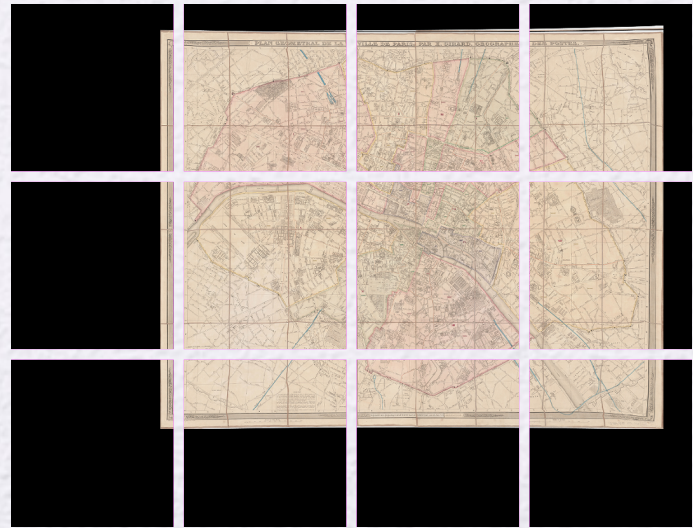
- 2. Tile-referenced background:



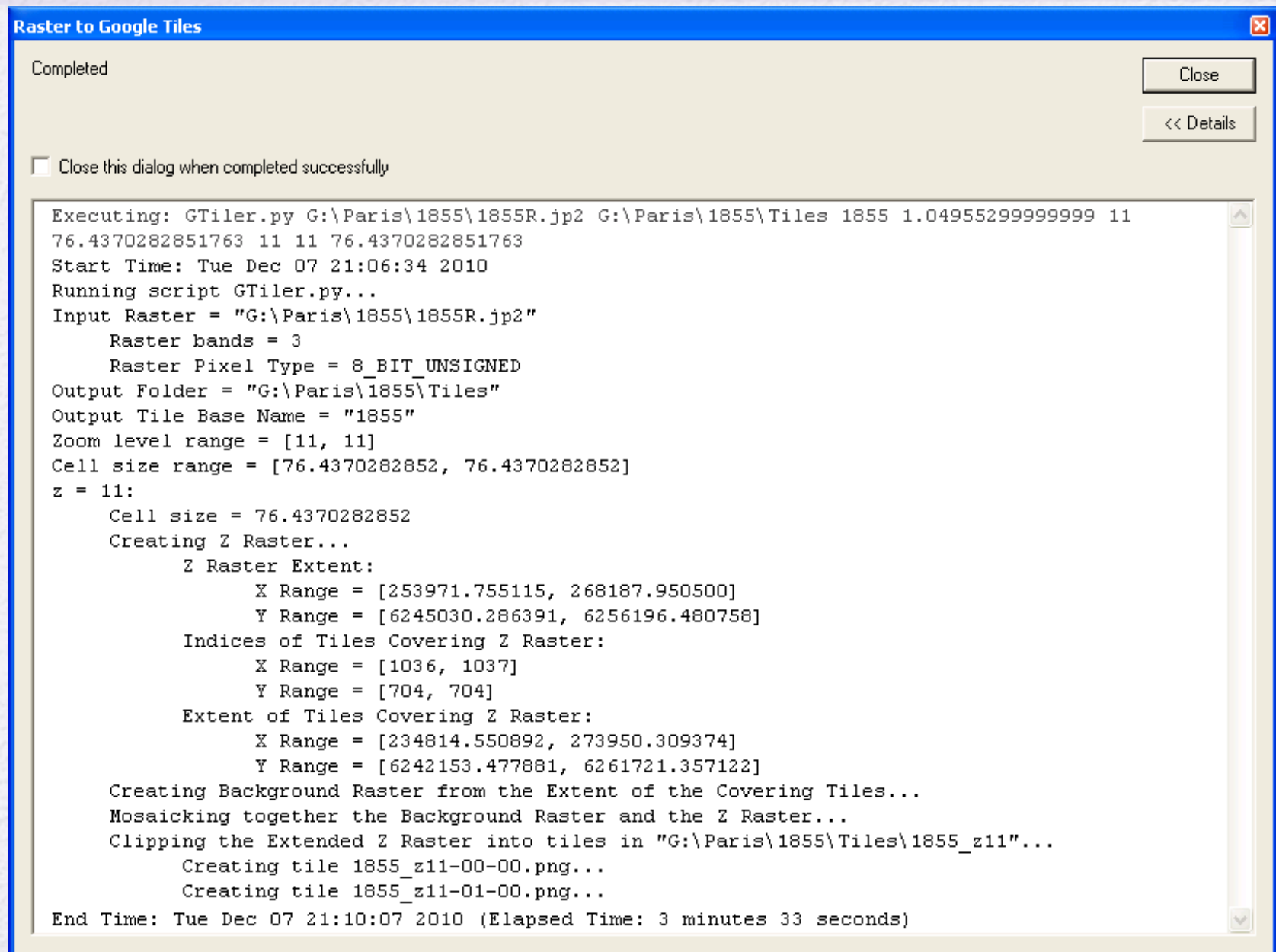
- 3. Map & background mosaic:



- 4. Mosaic tiles:



GTiler Execution



The screenshot shows a Windows-style dialog box titled "Raster to Google Tiles". The status bar at the top left says "Completed". On the top right, there are two buttons: "Close" and "<< Details". Below the status bar, there is a checkbox labeled "Close this dialog when completed successfully" which is currently unchecked. The main area of the dialog contains a text box with the following execution log:

```
Executing: GTiler.py G:\Paris\1855\1855R.jp2 G:\Paris\1855\Tiles 1855 1.04955299999999 11
76.4370282851763 11 11 76.4370282851763
Start Time: Tue Dec 07 21:06:34 2010
Running script GTiler.py...
Input Raster = "G:\Paris\1855\1855R.jp2"
    Raster bands = 3
    Raster Pixel Type = 8_BIT_UNSIGNED
Output Folder = "G:\Paris\1855\Tiles"
Output Tile Base Name = "1855"
Zoom level range = [11, 11]
Cell size range = [76.4370282852, 76.4370282852]
z = 11:
    Cell size = 76.4370282852
    Creating Z Raster...
        Z Raster Extent:
            X Range = [253971.755115, 268187.950500]
            Y Range = [6245030.286391, 6256196.480758]
        Indices of Tiles Covering Z Raster:
            X Range = [1036, 1037]
            Y Range = [704, 704]
        Extent of Tiles Covering Z Raster:
            X Range = [234814.550892, 273950.309374]
            Y Range = [6242153.477881, 6261721.357122]
    Creating Background Raster from the Extent of the Covering Tiles...
    Mosaicking together the Background Raster and the Z Raster...
    Clipping the Extended Z Raster into tiles in "G:\Paris\1855\Tiles\1855_z11"...
        Creating tile 1855_z11-00-00.png...
        Creating tile 1855_z11-01-00.png...
End Time: Tue Dec 07 21:10:07 2010 (Elapsed Time: 3 minutes 33 seconds)
```


Amherst Mapping App

- aMapApp uses the Google Maps API, directing it to use the tiles from the local web server to build a combined map.
- aMapApp is a light-weight framework, requiring:
 - PHP • MySQL
- A small amount of configuration, e.g.

```
require_once "/path_to_config_file/your_config_file.php";
```

- A simple API — if you want to extend its behavior, e.g.

```
newLocation(configObject)
```


Cityscapes Team

- **Inspiration:** Professors Sam Morse and Hélène Visentin
- **Organizer:** Scott Payne, Director of [Academic Technology Services](#) at [Amherst College](#)
- **Historical Map Georeferencing:** [Andy Anderson](#), ATS; Zoë Zaferiou and Jon Caris, Smith College
- **[GTiler](#) Creation:** [Andy Anderson](#), ATS
- **[aMapApp](#) Creation:** Paul Chapin, ATS
- **Image Database Interface:** Miodrag Glumac, ATS
- **Historical Maps:** Smith College, Harvard University, University of California at Berkeley, David Rumsey Map Collection