TRAINING WORKSHOP ON DATA AND MAPS @ CDD

JONATHAN PHILLIPS, HARVARD UNIVERSITY

1 - Introduction

What Does a Map Communicate?

- In pairs:
  - Think of some important issue that affects Ghana – maybe an issue from your own work
  - What information/data can help you describe and measure that issue?
  - Draw the best map you can of Ghana that represents that issue and its data

What Does a Map Communicate?

- In pairs:
  - Think of some important issue that affects Ghana
  - What information/data can help you describe and measure that issue?
  - Draw the best map you can of Ghana that represents that issue and its data
- Share your Map with another pair:
  - Can you tell what the map represents?
  - How would you improve the map?

Workshop Objectives

- Improve data 'numeracy' and map `literacy'
  - Know where to look online for data and maps
- Ensure everyone can read and produce a basic digital map
  - And that you know where to search for help
- Gain skills in reliable spatial data collection
  - So CDD can be a *producer* of data and maps
- Improve data analysis and mapping skills
  - So you can better answer policy questions
- Innovate! We'll start a new project to collect road quality data and display it on maps

The Data and Mapping Process

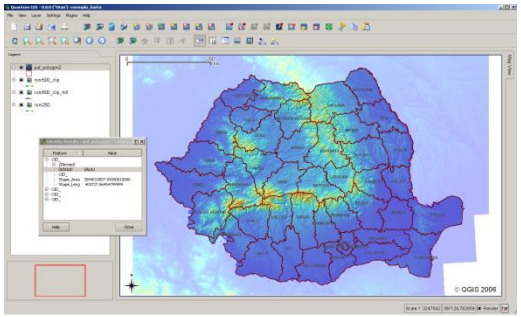
Primary Data Collection

Secondary Data Collection

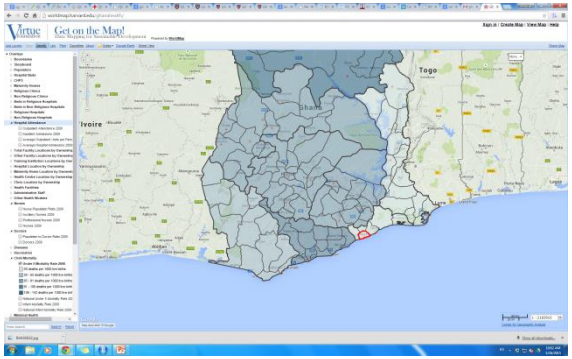
TABLE 5
Public irrigation schemes in Ghana in 2000

Name of irrigation Scheme	Region	Equipped area (ha)
Ashaiman	Greater Accra Region	155
Weija	Greater Accra Region	200
Dawhenya	Greater Accra Region	400
Kpong (Right bank)	Greater Accra Region	2 700
Aveyime	Volta Region	280
Afife	Volta Region	880
Kpando Torkor	Volta Region	80
Amate	Eastern Region	60
Dedeso	Eastern Region	40
Okyereko	Central Region	40
Mankessim	Central Region	40
Kikam	Western Region	27
Akomadan	Ashanti Region	60
Anum valley	Ashanti Region	100
Tanoso	Ashanti Region	60
Sata	Ashanti Region	40
Subinja	Brong-Ahafo Region	60
Bontanga	Northern Region	450
Golinga	Northern Region	45
Ligba	Northern Region	40
Tono	Upper East Region	2 430
Vea	Upper East Region	400
TOTAL		**8 587**

Data Processing and Mapping



Sharing Data Online



Embedding Maps in Reports

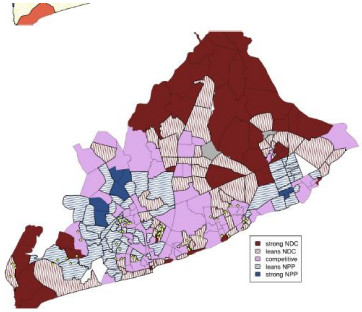


Figure 2: *Greater Accra urban area:* (a) the top panel shades the 238 urban Electoral Areas (or wards) by their majority ethnic group; (b) the bottom panel shades Electoral Areas by 2008 presidential vote share. "Strong" areas are where each party received more than 65%, "lean" where each received between 55% and 65%, and "competitive" where neither received more than 55%. Points in each panel show the centroids of the clusters of survey respondents. Gray shading indicates missing data.

The Data and Mapping Process

Primary Data Collection

ODK
Kobo Toolkit
Contour Cameras

Secondary Data Collection

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Name of irrigation Scheme	Region	Equipped area (ha)
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Amate	Eastern Region	60
Dedeso	Eastern Region	40
Okyereko	[illegible]	40
Mankessim	[illegible]	40
Kikam	Western Region	27
Akomadan	Ashanti Region	60
Anum v[illegible]	Ashanti Region	100
Tanoso	Ashanti Region	60
Sata	Ashanti Region	40
Subinja	Brong-Ahafo Region	60
Bontanga	Northern Region	450
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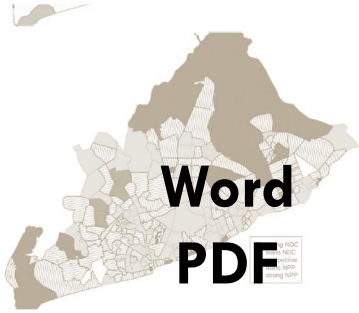
GADM
Worldmap
Google Search

Data Processing and Mapping

Sharing Data Online

Embedding Maps in Reports



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Terminology

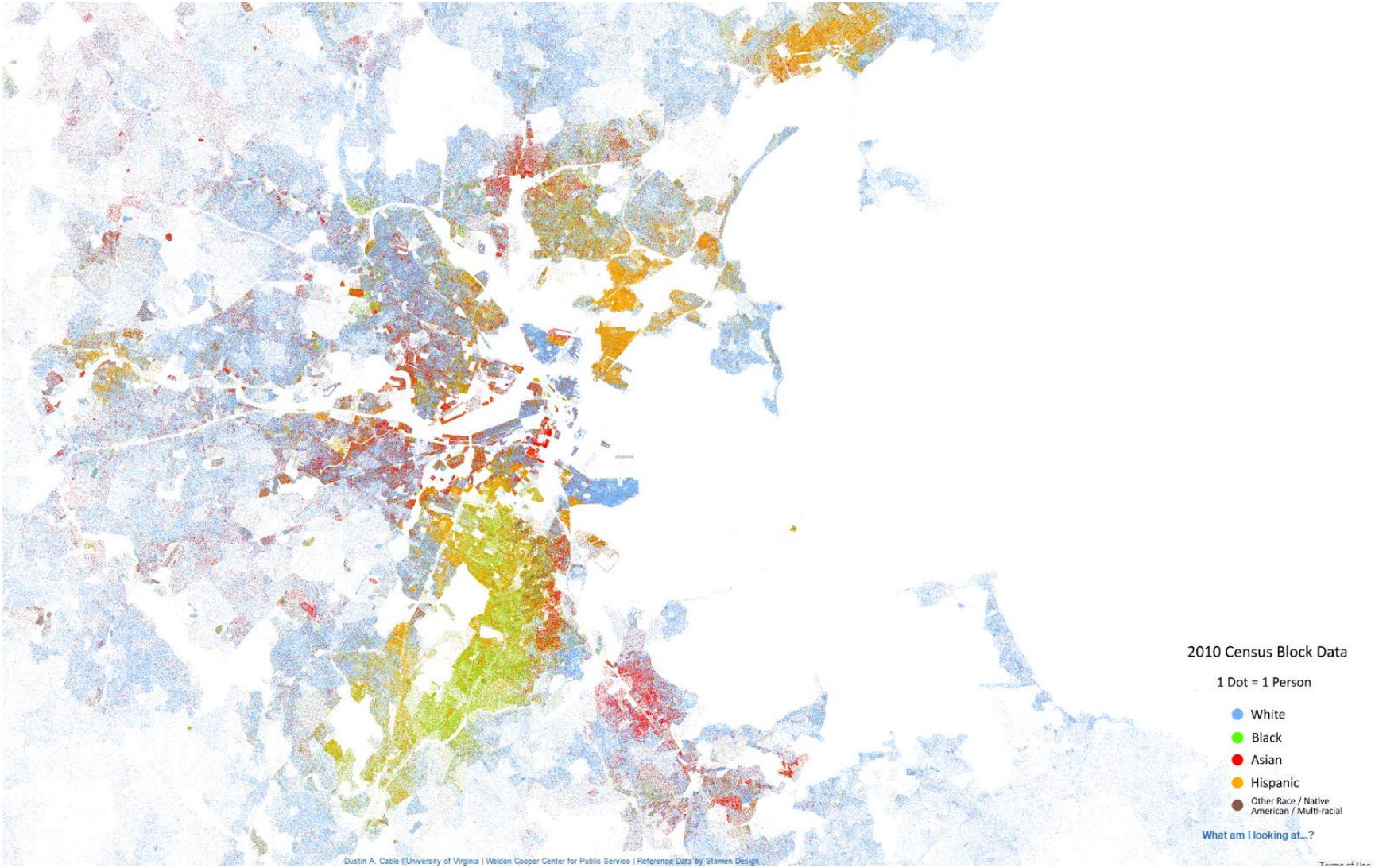
- `Spatial' – anything that has a location in space
- `Georeferenced' data – Data that has a location attached to it
- `Geographic Information System' (GIS) - "Set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes" (Burrough)
- `Shapefile' – The main file/document type for storing maps and GIS data

Reading Maps

Reading Maps

Data Number	Country Name	Paid Maternal Leave
1	Canada	26 weeks or more
2	USA	No paid leave
3	Mexico	Less than 14 weeks
4	Cuba	26 weeks or more
5	Brazil	14-25 weeks

Reading Maps



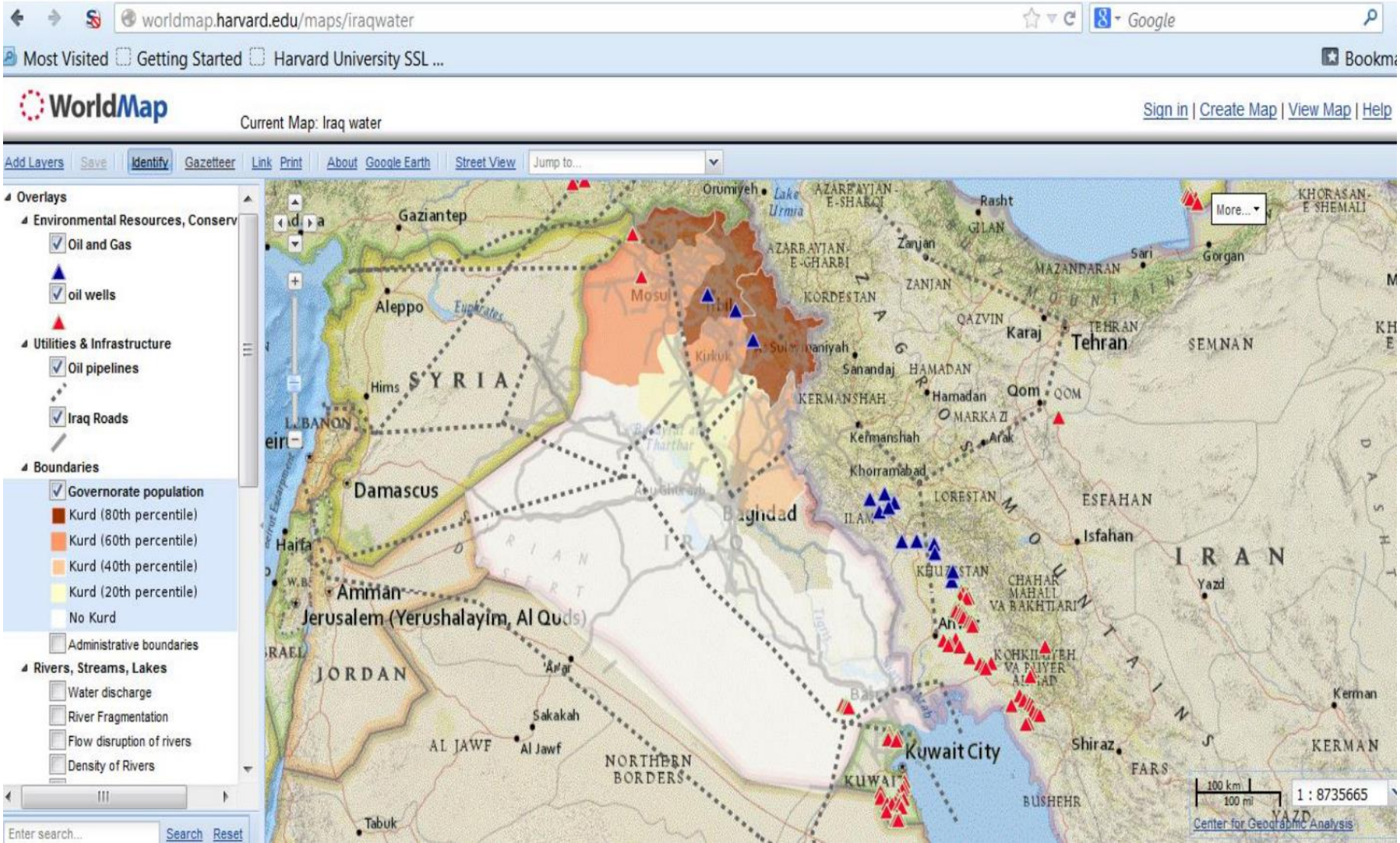
Reading Maps

Data Number	Location	Race
1	-20.9363 W, 34.3281 N	White
2	-21.7612W , +34.8287 N	White
3	-20.8732 W, +35.0181 N	Hispanic
4	-20.5519 W, +34.2398 N	White
5	- 21.3497 W, +34.8912 N	Black

Reading Maps

Reading Maps

Reading Maps

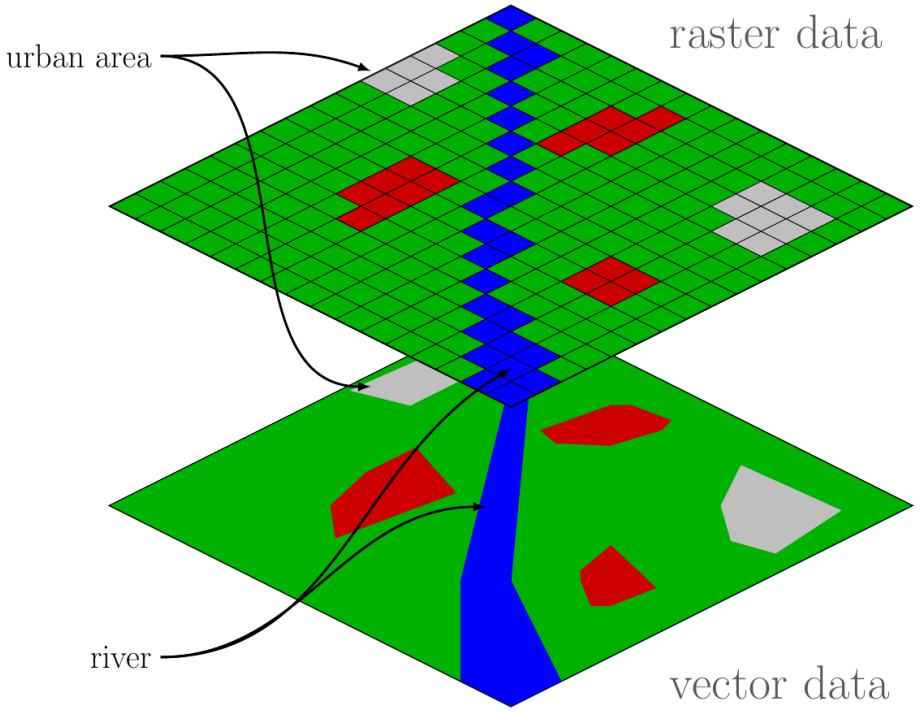


Elements of Maps

- Scale – What Part of the World do we Want to Represent?
- Data Shape – Areas, Points, Lines, Raster?
- Colours – Meaningful or just pretty?
- Data Unit – Number, Percentage, Categories?
- Background – Blank, Country outlines, street maps?
- Orientation – Compass, Scale, Labels?

Spatial Types

- Vector Data
  - Points
  - Lines
  - Areas
- Raster Data
  - A regular grid
  - Each square has a value



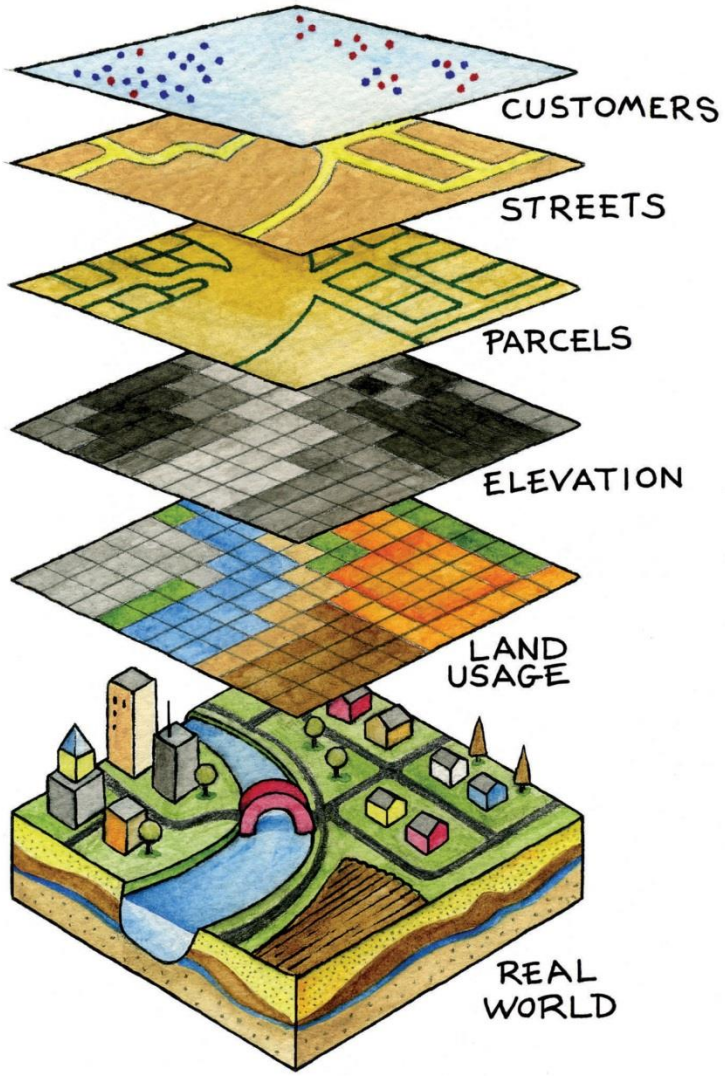
Data Types

- We can display ANY type of data on maps
- It's crucial to pick the best data type for the point you want to communicate:
  - Raw numbers (count) data (eg. 24 cases of fraud)
  - Percentages (eg. 20%; % of what??)
  - Density (eg. 100 people per km^2)
  - Rates (eg. 1,000 accidents per month)
  - Unordered Categories (eg. Car, Rail, Bicycle)
  - Ordered Categories (eg. Agree, Neutral, Disagree)
  - Binary (eg. Yes/No)

Thinking in `Layers'

- Usually we want to combine multiple *types* of data from multiple sources to conduct our analysis
- So we need to `layer' the data on top of each other to compare
- This enables us to investigate spatial relationships
  - Eg. are there more hospitals in Upper West than Upper East?
  - Eg. Do more people vote if they live near a polling station?

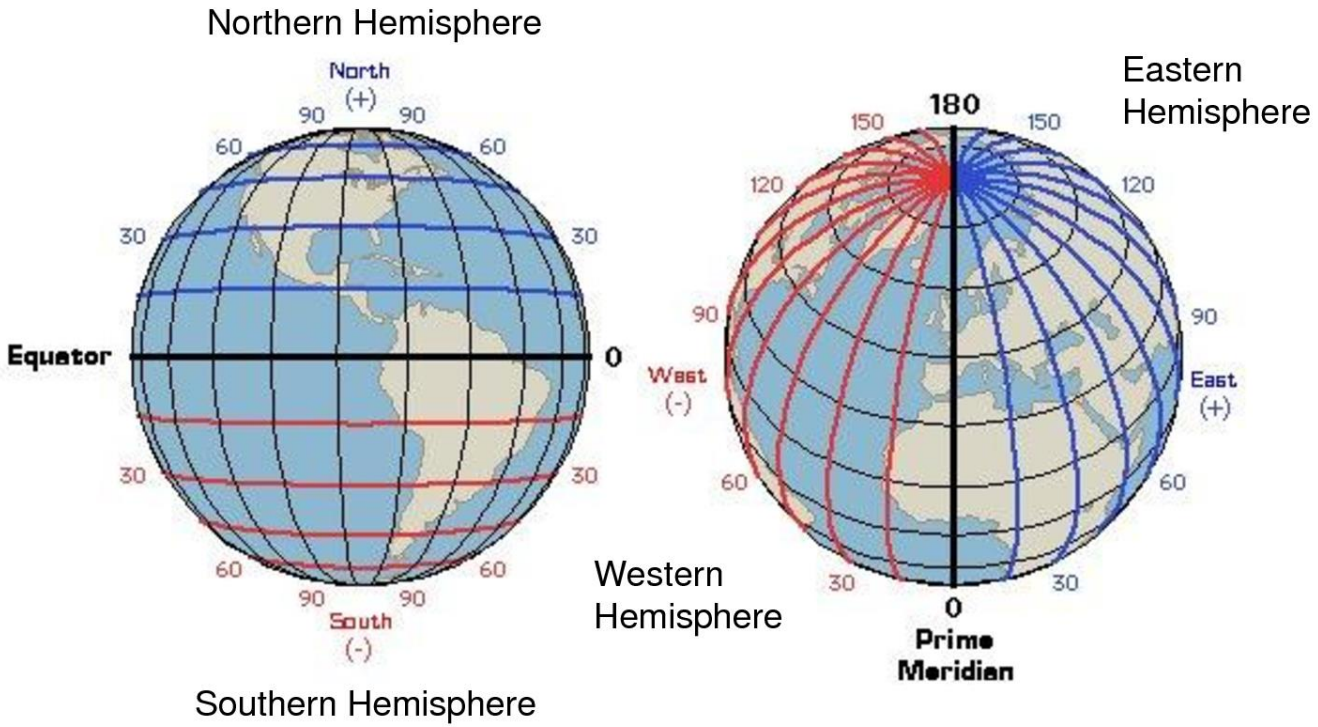
Thinking in `Layers'



Thinking Spatially

- How do we know the location of something in space?
  - We need a common language to talk about space
  - We use longitude, latitude = x, y
  - Possibly also z for height
- So every piece of our data needs to be linked to an x, y location
  - Points have a single x, y
  - Areas have a bunch of x, y points describing their boundary

Longitude, Latitude

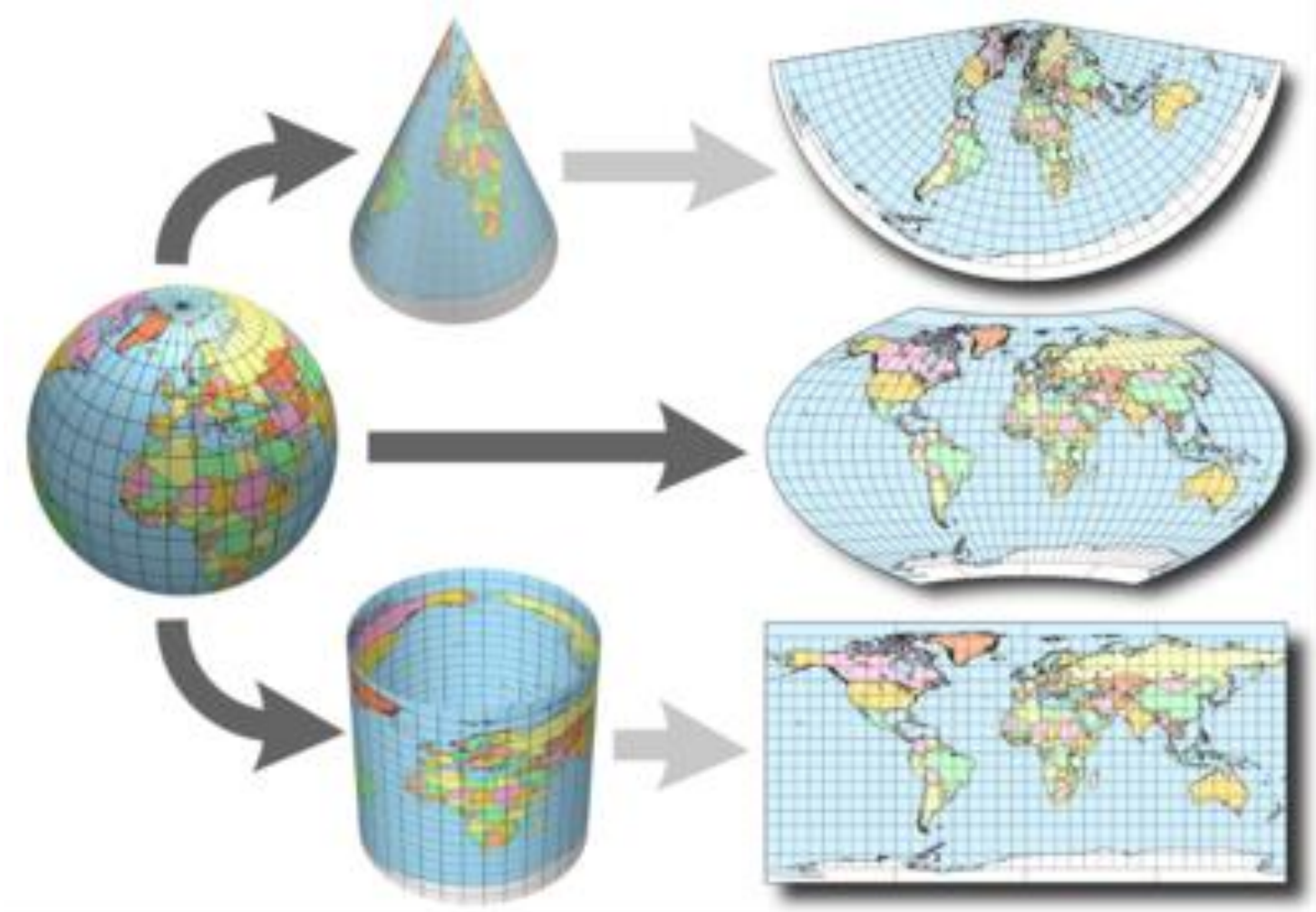


Latitude & Longitude

One Complication

- The Earth is Not Flat!
  - But we tend to look at maps on flat surfaces
- x, y makes sense only on a flat surface
- What do we do about it?
  - We `project' the earth onto a flat surface using some maths
  - In practice, all we need to do is make sure we collect data in the same projection (format) that we analyze it in
  - In general, that means a projection called `WGS84'

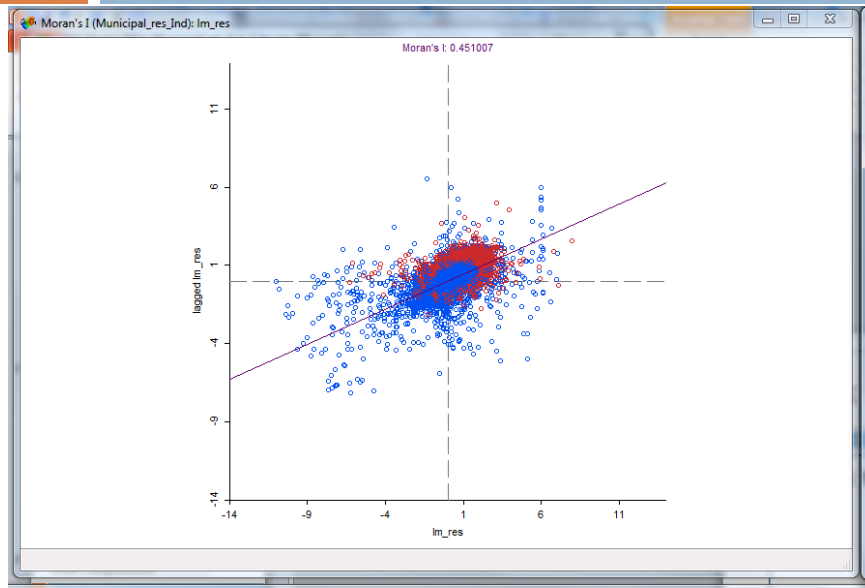
One Complication

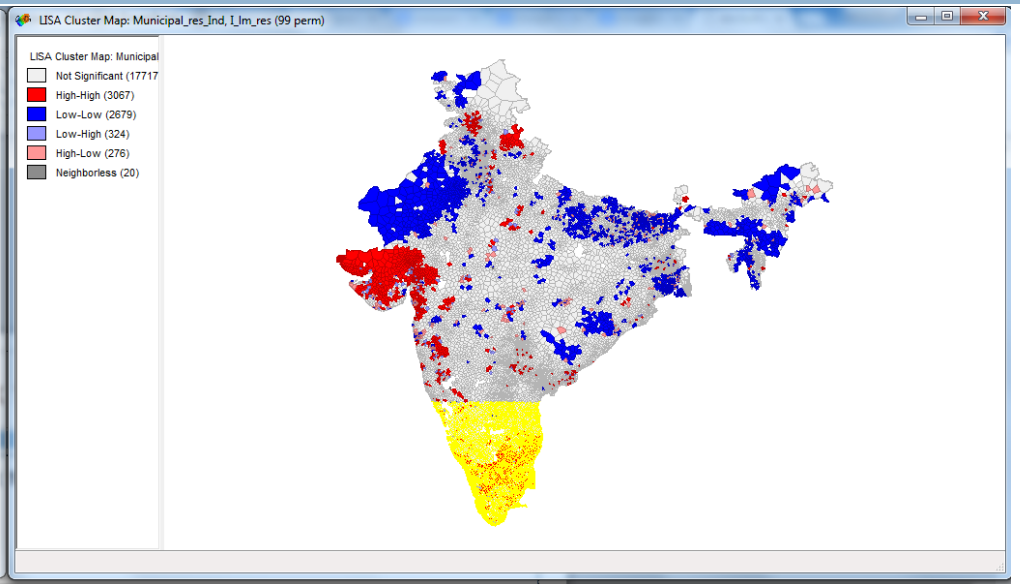


Storing Spatial Data

- Normal data might be stored in a spreadsheet (eg. Excel)
- Spatial data is usually stored in a `shapefile'
  - A shapefile is basically a description of a map
  - A list of x, y coordinates for each piece of data
  - Any attributes – the actual data – attached to those coordinates
  - Shapefiles can be points, lines or areas

Storing Spatial Data





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ncode	OBJECTID	Id	Input_FID	ISO	COUNTRY	LANGUAGE	ID_1	State_x	REGION2	District	Sub_Distri	LOCALITY	SUBURB	LATITUDE	LONGITUDE	ELEVATION	ISO2	FIPS	NUTS	HASC	STAT	TIMEZO
2265	2	0	27417	IN	India	EN	1000651744.000000	Gujarat		Ahmadabad	Dholka	Virdi		22.59556200000000	72.41397900000000	0.000000000000000	IN-GJ	IN09		IN.GJ.AH	474	Asia/Kolkata
1170	4	0	3946	IN	India	EN	1000625362.000000	Andhra Pradesh		Krishna	Krishna	Chowtapalli		16.41258900000000	81.04372300000000	0.000000000000000	IN-AP	IN02		IN.AP.KR	547	Asia/Kolkata
2407	5	0	110274	IN	India	EN	1000734783.000000	Tamil Nadu		Pudukkottai	Tirumayam	Vegupatti		10.27490300000000	78.54904900000000	0.000000000000000	IN-TN	IN25		IN.TN.PU	621	Asia/Kolkata
4616	6	0	110042	IN	India	EN	1000734551.000000	Tamil Nadu		Pudukkottai	Arantangi	Veeramangalam		10.14297800000000	79.04190500000000	0.000000000000000	IN-TN	IN25		IN.TN.PU	621	Asia/Kolkata
4103	7	0	55540	IN	India	EN	1000679867.000000	Karnataka	Mysore	Udupi	Udupi	Hejmadikodi		13.11629700000000	74.78344500000000	0.000000000000000	IN-KA	IN19		IN.KA.UD	569	Asia/Kolkata
2149	8	0	45911	IN	India	EN	1000670238.000000	Karnataka	Bangalore	Bangalore	Bangalore North	Kannur		13.11872300000000	77.68797000000001	0.000000000000000	IN-KA	IN19		IN.KA.BN	572	Asia/Kolkata
3331	9	0	5900	IN	India	EN	1000630731.000000	Andhra Pradesh		Prakasam	Markapur	Yadavalli		16.01397800000000	78.97407300000000	0.000000000000000	IN-AP	IN02		IN.AP.PR	549	Asia/Kolkata
7118	10	0	48694	IN	India	EN	1000673021.000000	Karnataka	Belgaum	Bagalkot	Hungund	Timmapur		16.14555000000000	76.10880000000000	0.000000000000000	IN-KA	IN19		IN.KA.BK	556	Asia/Kolkata
4110	11	0	75196	IN	India	EN	1000699523.000000	Maharashtra	Nashik	Ahmednagar	Ahmednagar	MIRC		19.05211300000000	74.76296600000001	0.000000000000000	IN-MH	IN16		IN.MH.AH	522	Asia/Kolkata
4444	12	0	23291	IN	India	EN	1000647618.000000	Chhattisgarh		Bijapur	Bijapur	Tumnar		19.04914700000000	80.72144200000000	0.000000000000000	IN-CT	IN37		IN.CT.BJ	417	Asia/Kolkata
5023	13	0	89233	IN	India	EN	1000713560.000000	Odisha		Rayagada	Gunupur	Penakham		19.10415600000000	83.69865700000000	0.000000000000000	IN-OR	IN21		IN.OR.RA	396	Asia/Kolkata
1631	14	0	145823	IN	India	EN	1000763032.000000	West Bengal	Burdwan	Purba Medini	Nandigram	Nandigram		22.00766300000000	87.98383100000000	0.000000000000000	IN-WB	IN28		IN.WB.EM	345	Asia/Kolkata
5223	15	0	23306	IN	India	EN	1000647633.000000	Chhattisgarh		Bilaspur	Bilaspur	Bilaspur Industria		22.03347200000000	82.05161000000000	0.000000000000000	IN-CT	IN37		IN.CT.BI	406	Asia/Kolkata
1240	16	0	35280	IN	India	EN	1000659607.000000	Gujarat		Vadodara	Vadodara	Varnama		22.08346600000000	73.11135600000000	0.000000000000000	IN-GJ	IN09		IN.GJ.VD	486	Asia/Kolkata
0520	17	0	29626	IN	India	EN	1000654001.000000	Gujarat		Jamnagar	Jamjodhpur	Vadala Sethna		22.05877000000000	70.12176500000000	0.000000000000000	IN-GJ	IN09		IN.GJ.JA	477	Asia/Kolkata
8770	18	0	63129	IN	India	EN	1000687456.000000	Madhya Pradesh	Gwalior	Shivpuri	Kolaras	Ramgarh		25.02859000000000	77.67651800000000	0.000000000000000	IN-MP	IN35		IN.MP.SV	423	Asia/Kolkata
5331	19	0	66492	IN	India	EN	1000690819.000000	Madhya Pradesh	Rewa	Satna	Raghurajnagar	Singhpur		24.94376500000000	80.67707900000001	0.000000000000000	IN-MP	IN35		IN.MP.ST	429	Asia/Kolkata
1101	20	0	18739	IN	India	EN	1000643066.000000	Bihar	Patna	Kaimur	Bhabua	Ujari Sikathi		25.00910200000000	83.71991400000000	0.000000000000000	IN-BR	IN34		IN.BR.KM	233	Asia/Kolkata
2106	21	0	16170	IN	India	EN	1000640497.000000	Bihar	Kosi	Saharsa	Simri Bakhtiarpur	Ghoghsam		25.03427000000000	86.68565900000000	0.000000000000000	IN-BR	IN34		IN.BR.SH	214	Asia/Kolkata
3817	22	0	11247	IN	India	EN	1000635574.000000	Assam		Cachar		Tikarburunga		25.04629300000000	92.67850900000001	0.000000000000000	IN-AS	IN03		IN.AS.CA	316	Asia/Kolkata
9639	23	0	129824	IN	India	EN	1000745615.000000	Uttar Pradesh	Bareilly	Budaun	Budaun	Ujhani		28.01987300000000	78.99668900000000	0.000000000000000	IN-UP	IN36		IN.UP.DA	149	Asia/Kolkata
3001	24	0	36478	IN	India	EN	1000660805.000000	Haryana	Gurgaon	Mahendragar		Bashirpur		28.01686200000000	76.06094800000000	0.000000000000000	IN-HR	IN10		IN.HR.MA	084	Asia/Kolkata
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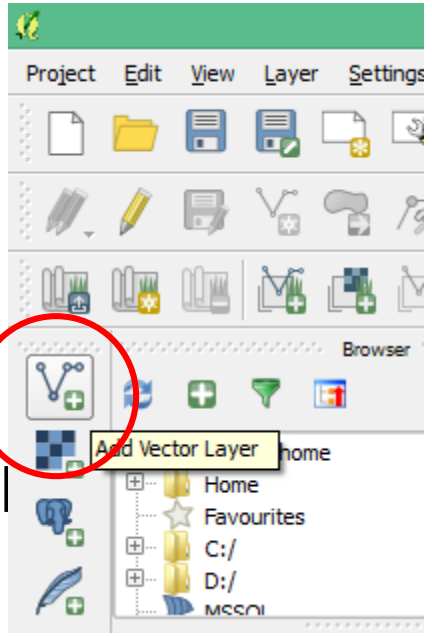
4301	26	0	41830	IN	India	EN	1000666157.000000	Jammu and Kash		Kargil		Yuljuk		34.01725300000000	76.03919100000000	0.000000000000000	IN-JK	IN12		IN.JK.KR	004	Asia/Kolkata

How Not to Get Lost

- What do I want to communicate?
- Who is my Audience?
- What data do I need? How many layers?
- What data type best reflects my argument?
- What type of spatial data is it (point/area)?

Recap

1. **Find your data** – existing shapefiles from worldmap, google etc.
2. In QGIS, `**Add Vector Layer**'
3. Right-click on the layer, `**Properties**'
4. Choose a **colour style** to represent
5. Choose the **data column** you want to re
6. Click `**Classify**'
7. Click `**OK**'



Recap

- Colour Styles must MATCH the data you want to represent
  1. **`Single Symbol' –** everything the same colour, for when your data doesn't vary across space
  2. **`Categorized' –** when your data is distinct categories, eg. `bitumen', `asphalt', `gravel'
  3. **`Graduated' –** when your data is continuous numbers, eg. 0-100, and the colour should *gradually* change

Spatial Analysis Questions

1. How many health clinics are in each district?
2. Where are the best health facilities concentrated?
3. What is the average quality of roads in each district?
4. What is the average length of roads in each district?

Your turn!

1. Think of a Policy Question
2. Identify what data you need to answer it
3. Find appropriate data sources online
4. Plan what your final map will look like
5. Import the data to QGIS
6. Analyze the data in QGIS
7. Represent the data with a clear colour scheme
8. Produce a PDF of the document
9. Email to jonnyphillips@gmail.com

EXAMPLE QUESTION: Which districts have the schools with the highest completion rates?

Example Question

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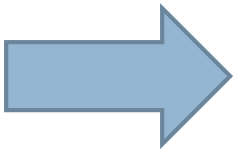
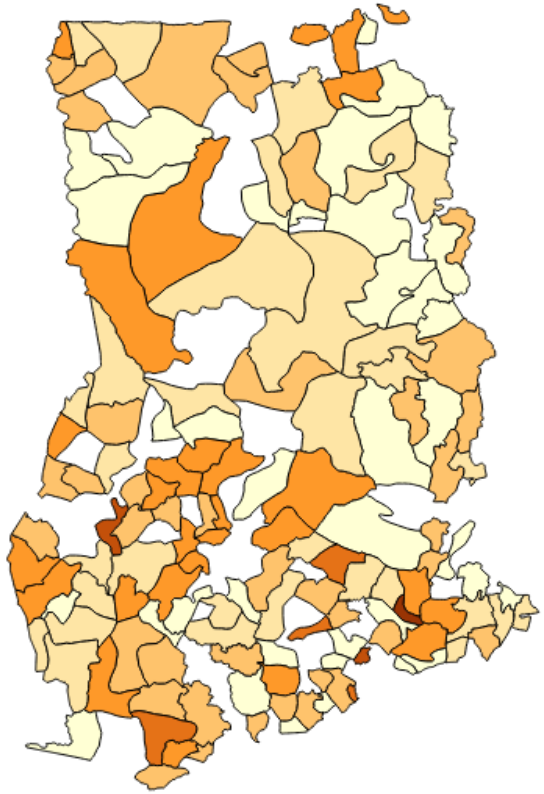
2- Data Wrestling

From Tables to Maps!

- The goal: To take data from a spreadsheet and put it in maps

2	Code#	Regions	Districts	Institutional Infant Mortality Rate 2014
3	1	Ashanti	Adansi North	0
4	2	Ashanti	Adansi South	0
5	3	Ashanti	Afigya-Kwabre	0
6	4	Ashanti	Ahafo-Ano North	0
7	5	Ashanti	Ahafo-Ano South	0
8	6	Ashanti	Amansie Central	0
9	7	Ashanti	Amansie West	2.5
10	8	Ashanti	Asante-Akim Central	0.46
11	9	Ashanti	Asante-Akim North	11.5
12	10	Ashanti	Asante-Akim South	0
13	11	Ashanti	Asante-Mampong	0
14	12	Ashanti	Asokore-Mampong	0
15	13	Ashanti	Atwima-Kwanwoma	0
16	14	Ashanti	Atwima-Mponua	0.47
17	15	Ashanti	Atwima-Nwabiagya	0.16
18	16	Ashanti	Bekwai	6
19	17	Ashanti	Bosome-Freho	0
20	18	Ashanti	Bosomtwi	0

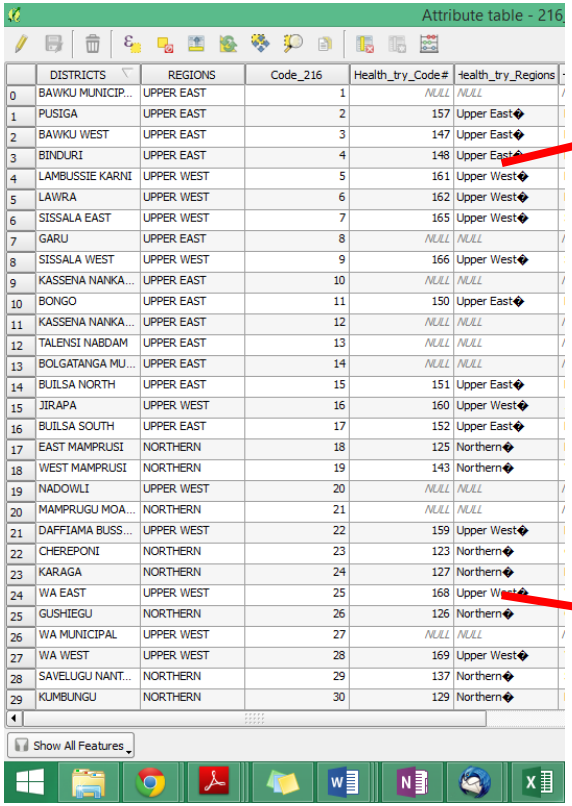


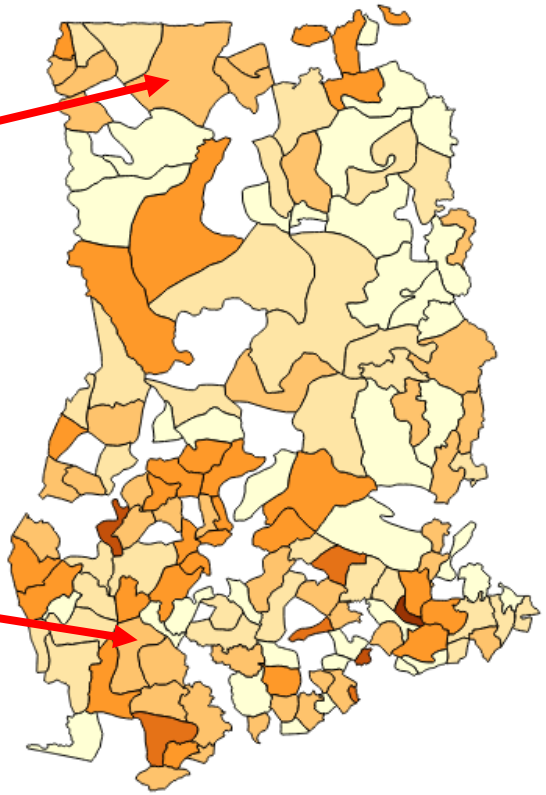


Using District Codes to Import

- Our map is already a table!
- With codes for each district and 216 rows

Districts	Institutional Infant Mortality Rate 2014
Adansi North	0
Adansi South	0
Afigya-Kwabre	0
Ahafo-Ano North	0
Ahafo-Ano South	0
Amansie Central	0
Amansie West	2.5
Asante-Akim Central	0.46
Asante-Akim North	11.5
Asante-Akim South	0
Asante-Mampong	0
Asokore-Mampong	0
Atwima-Kwanwoma	0
Atwima-Mponua	0.47
Atwima-Nwabiagya	0.16
Bekwai	6
Bosome-Freho	0
Bosomtwi	0





Template Shapefile and Table

	DISTRICTS	REGIONS	Code_216
0	BAWKU MUNICIP...	UPPER EAST	1
1	PUSIGA	UPPER EAST	2
2	BAWKU WEST	UPPER EAST	3
3	BINDURI	UPPER EAST	4
4	LAMBUSSIE KARNI	UPPER WEST	5
5	LAWRA	UPPER WEST	6
6	SISSALA EAST	UPPER WEST	7
7	GARU	UPPER EAST	8
8	SISSALA WEST	UPPER WEST	9
9	KASSENA NANKA...	UPPER EAST	10
10	BONGO	UPPER EAST	11
11	KASSENA NANKA...	UPPER EAST	12
12	TALENSI NABDAM	UPPER EAST	13
13	BOLGATANGA MU...	UPPER EAST	14
14	BUILSA NORTH	UPPER EAST	15
15	JIRAPA	UPPER WEST	16
16	BUILSA SOUTH	UPPER EAST	17
17	EAST MAMPRUSI	NORTHERN	18

- One for 170 Districts
- One for 216 Districts

STEP 1: Prepare your Indicator

- IN EXCEL:
- What Indicator do you want to Map?
- Prepare the column for that indicator
  - Eg. Pupil-to-teacher ratio
  - May require combining multiple columns
  - Convert it into the units you want to appear on your map
  - Clean the spreadsheet (no blank space, column headings etc.)
- Make sure missing data is recorded as a blank cell (not a zero)

STEP 2: Match to the District Code

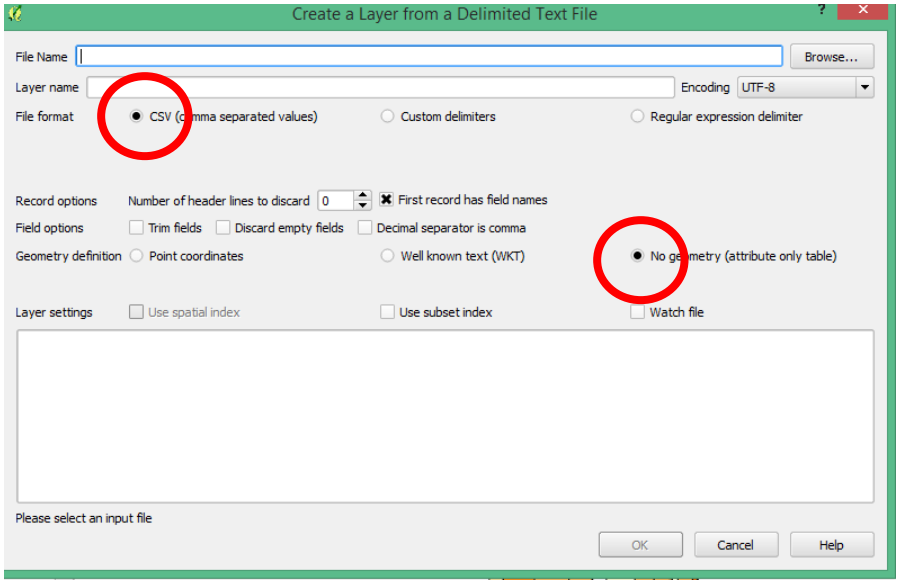
- IN EXCEL:
- In your data's district names, replace "-" with "-" (use Find, Replace)
- Add column called "Code_216"
- In this column, create a vlookup formula that looks up the district name in the TEMPLATE table, and returns the code for that district
  - e.g. =VLOOKUP(E2,'216_districts_TEMPLATE.dbf'!A$2:C$217,3,FALSE)

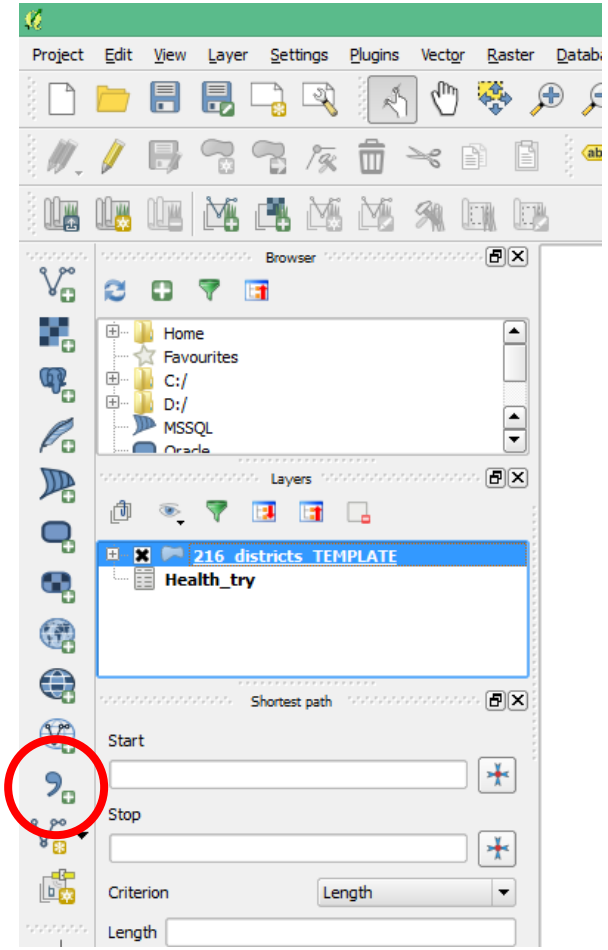
STEP 2: Match to the District Code

- Match missing codes by hand – input the district code in the "Code_216" column in your data excel file
- Double-check the right districts or in the right region
- Save the data file as a .csv

STEP 3: Import data table to QGIS

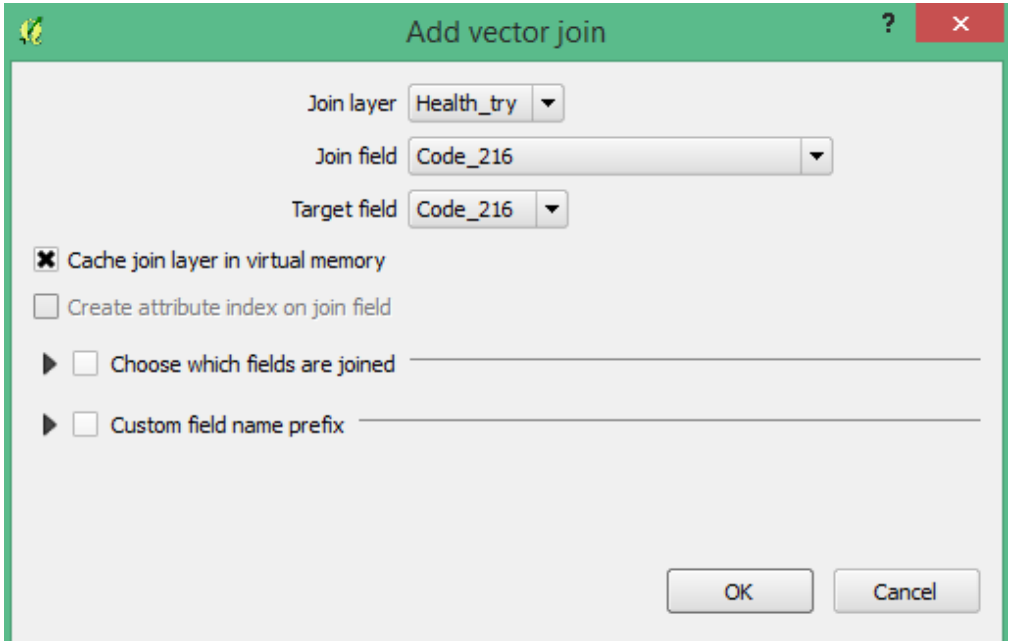
- Open the template shapefile for the districts
- "Add Delimited Text Layer"
- Select your file, choose "CSV" and "No geometry"





STEP 4: Join Template map to Table

- Right-click on the Districts Template shapefile
  - Choose `Properties', then `Join'
  - Click the `+' sign
  - Select the relevant layer, and the "Code_216" columns to join



STEP 5: Represent your Indicator

- The columns from your data are now in the table for your map!
- Right-click on the Districts shapefile, `Properties', `Style'
- Choose a colour scheme to represent your data (probably graduated)
- Double-check your mapped data looks right!

STEP 6: Export to PDF/Worldmap

- PDF:
  - `Project', `New Print Composer', `Add Map'…
  - `Export to PDF'
- Worldmap:
  - Right-click the District map, `Save as…'
  - To export the colour scheme, right0click the Districts map, `Properties', `Style', `Style', `Save Style', `SLD'

STEPS

- STEP 1: **Prepare** your Indicator
- STEP 2: **Match** data to the District Code (vlookup)
  - =VLOOKUP(E2,'216_districts_TEMPLATE.dbf'!A$2:C$217,3,FALSE)
- STEP 3: **Import** data table to QGIS
- STEP 4: **Join** Template map to Table
- STEP 5: **Represent** your Indicator
- STEP 6: **Export** to PDF/Worldmap

TRAINING WORKSHOP ON DATA AND MAPS @ CDD

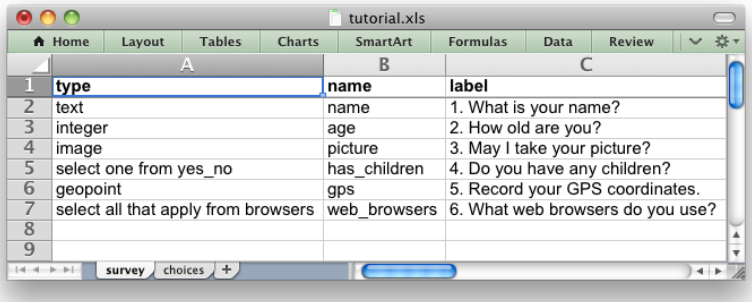
JONATHAN PHILLIPS, HARVARD UNIVERSITY

3 – Smartphone Data Collection

Primary Data Collection

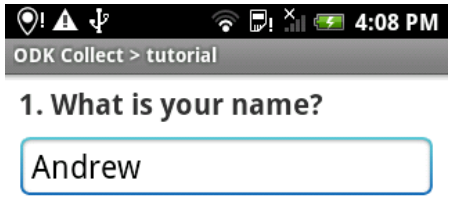
- Up to Today we have used `secondary' (existing) data
- What if the data we want does not exist?
  - Let's collect it ourselves!
  - I.e. Primary data collection
- CDD is already an expert in surveys

Smart Survey Data Collection Framework

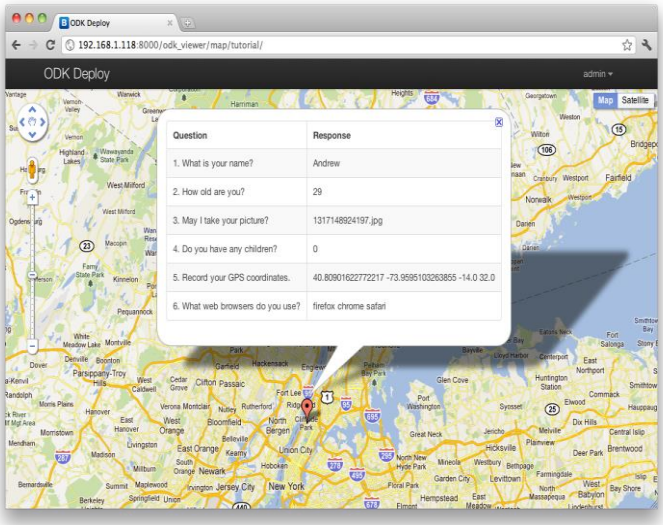


	A	B	C
1	type	name	label
2	text	name	1. What is your name?
3	integer	age	2. How old are you?
4	image	picture	3. May I take your picture?
5	select one from yes_no	has_children	4. Do you have any children?
6	geopoint	gps	5. Record your GPS coordinates.
7	select all that apply from browsers	web_browsers	6. What web browsers do you use?
8			
9			

Prepare surveys



Collect data on smartphone



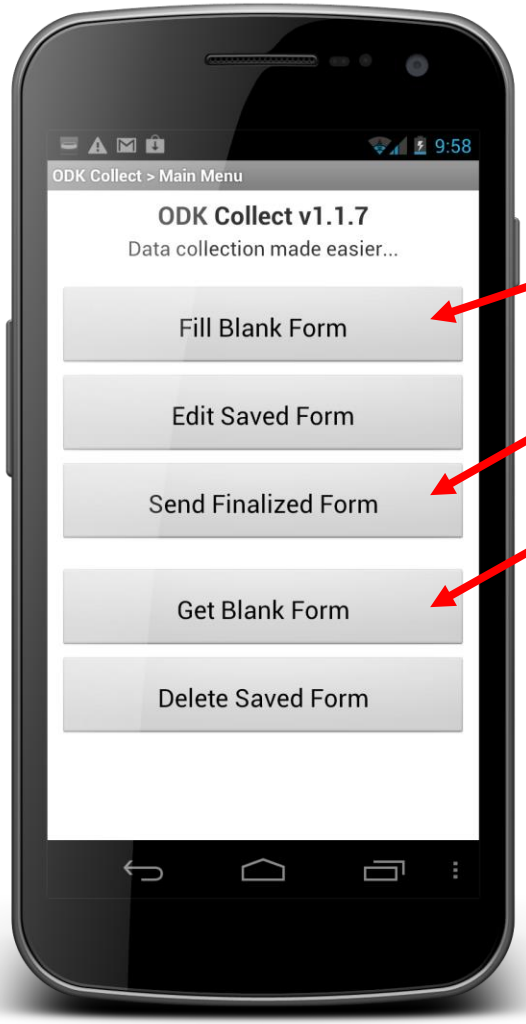
View / download / analyze data

Smartphone Data Collection

1. **More reliable data collection** – errors are caught on entry (eg. age=200) and no need for manual data entry from paper copies
2. **More reliable data storage** – data immediately sent back to online server
3. **New functions** – quickly collect photos, GPS etc. with one device
4. **Real-time Analysis** – Patterns and challenges in the field can be immediately noticed
5. **Efficient supervision and support** – progress in surveys and location can be monitored remotely

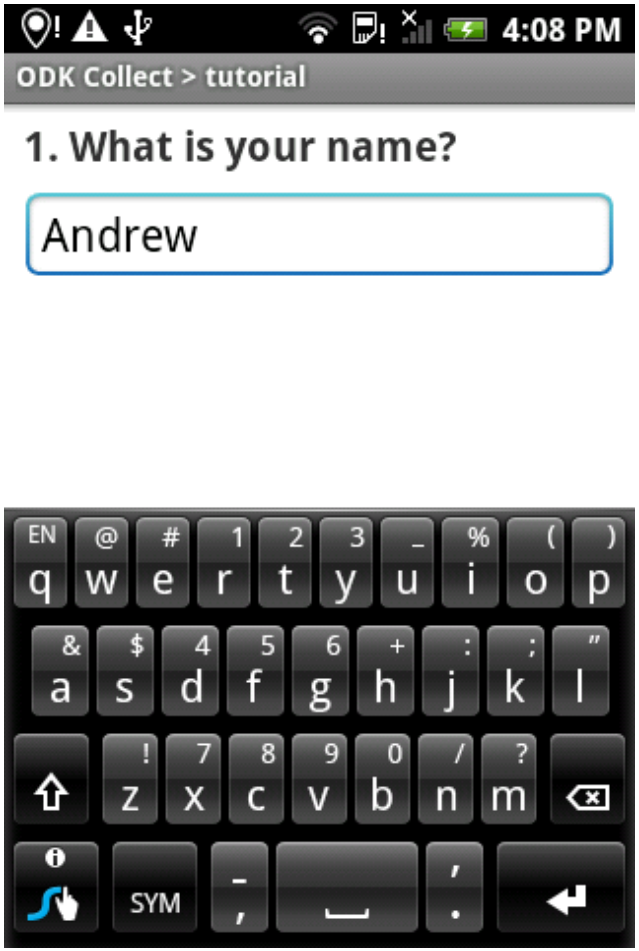

Battery Indicator
Power Button –
Hold for 5 seconds
Network Indicator
Charging Socket
Volume –
Up/Down
Touchscreen
Camera
‘Options’ button
‘Back’ Button
‘Menu’ Button
‘Select’ button
SAMSUNG
12:45 PM
Wed.
04/27
Gmail
Maps
Talk
Market
SAMSUNG

ODK Main Menu



- Start a New Survey
- Send Surveys to Server
- Download new survey template (only need to do this once)

ODK Filling Surveys



- Swipe right for the next question
- Enter the data using touch or keyboard
- Swipe right for the next question

ODK Question Types

- Single Choice (select_one)
- Multiple Choice (select_multiple)
- Text Input (text)
- Number input (integer)
- Picture (image)
- Audio Recording (audio)
- GPS point (geopoint)
- GPS area (geoshape)
- Many others…

Sending Data

- Auto-send using mobile networks
  - Where they are available and you have the right SIM
- Manually send on mobile networks at the end of the day
  - Choose `Send Finalized Form'
  - `Toggle all'
  - `Send selected'
- Backup to a computer – transfer through USB
- Return the Smartphone and download from the memory card

Producing Surveys

- OPTION 1: Kobotoolbox
  - Create an account
  - Click `Add form', `Start from Scratch'
  - Click `+'
  - Click `+Add Question'
  - Choose question type
  - Type the question name
  - Click `+' to add more questions

Producing Surveys

- OPTION 2: Write surveys in excel
  - One sheet for Questions - `survey'
  - One sheet for choices in multi-choice questions - `choices'
  - List each question as a new row
  - Define question type, unique name and how it will appear on the phone
  - Additional columns add advanced features
  - Upload completed excel sheet to kobotoolbox
  - Best to start from an existing survey template

Additional columns

- **Hint** – extra guidance on answering the question
- **Required** – Can't continue until you pick an answer
- **Relevant** – Only ask a question depending on a previous answer, like skip logic
- **Constraint** – Allow only certain types of answers
- **Label::language** – Alternative languages
- **Calculation** – perform a calculation and show it

Managing Surveys

- How do we get a survey from kobotoolbox to the smartphones?
  1. `Deploy' your survey from kobo – find your survey and click `Deploy form as survey project'
  2. Click `How to collect data on mobile device?' – copy the link, eg. https://kc.kobotoolbox.org/jonathanphillips
  3. On the phone, open ODK Collect, go to `settings', , and type this link into the phone
  4. In ODK Collect, click `Get blank Survey', select your survey, and `get selected'

Receiving Data

- All the surveys you conduct get sent back to a server (a computer)
- How do we collate and analyse this data?
- We can look at it online in kobotoolbox
  - It's a spreadsheet so every survey is a row
  - No data entry!
- We can also download it
  - And then map it!
  - In QGIS, google earth etc.

Practice Survey

- CDD Training 3

TRAINING WORKSHOP ON DATA AND MAPS @ CDD

JONATHAN PHILLIPS, HARVARD UNIVERSITY

4- Data Processes

The Data and Mapping Process

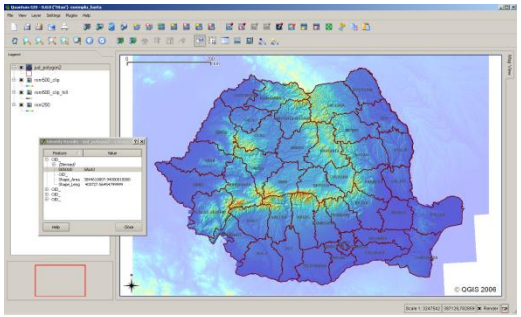
Primary Data Collection

Secondary Data Collection

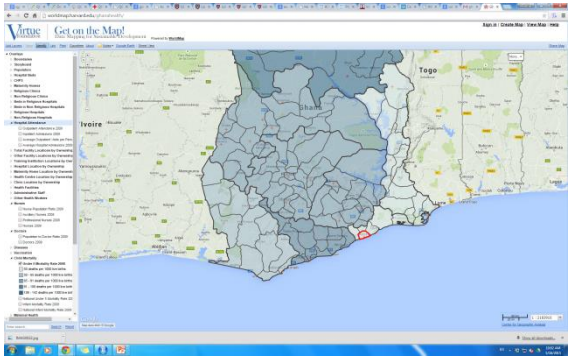
TABLE 5
Public irrigation schemes in Ghana in 2000

Name of irrigation Scheme	Region	Equipped area (ha)
Ashaiman	Greater Accra Region	155
Weija	Greater Accra Region	200
Dawhenya	Greater Accra Region	400
Kpong (Right bank)	Greater Accra Region	2 700
Aveyime	Volta Region	280
Afife	Volta Region	880
Kpando Torkor	Volta Region	80
Amate	Eastern Region	60
Dedeso	Eastern Region	40
Okyereko	Central Region	40
Mankessim	Central Region	40
Kikam	Western Region	27
Akomadan	Ashanti Region	60
Anum valley	Ashanti Region	100
Tanoso	Ashanti Region	60
Sata	Ashanti Region	40
Subinja	Brong-Ahafo Region	60
Bontanga	Northern Region	450
Golinga	Northern Region	45
Ligba	Northern Region	40
Tono	Upper East Region	2 430
Vea	Upper East Region	400
TOTAL		**8 587**

Data Processing and Mapping



Sharing Data Online



Embedding Maps in Reports

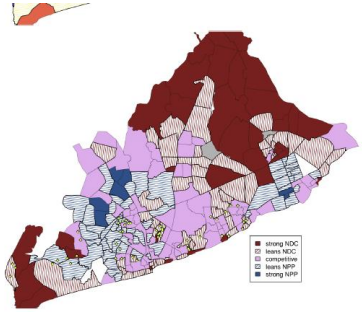


Figure 2: *Greater Accra urban area:* (a) the top panel shades the 238 urban Electoral Areas (or wards) by their majority ethnic group; (b) the bottom panel shades Electoral Areas by 2008 presidential vote share. "Strong" areas are where each party received more than 65%, "lean" where each received between 55% and 65%, and "competitive" where neither received more than 55%. Points in each panel show the centroids of the clusters of survey respondents. Gray shading indicates missing data.

The Data and Mapping Process

Primary Data Collection

ODK
Kobo Toolkit
Contour Cameras

Secondary Data Collection

TABLE 5
Public irrigation schemes in Ghana in 2000

Name of irrigation Scheme	Region	Equipped area (ha)
Ashaiman	Greater Accra Region	155
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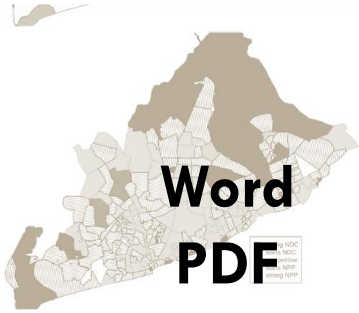
Dawhenya	Greater Accra Region	400
Kpong (Right bank)	[illegible]	2 700
Aveyime	[illegible]	280
Afife	[illegible]	880
Kpando Torkor	Volta Region	80
Amate	Eastern Region	60
Dedeso	Eastern Region	40
Okyereko	[illegible]	40
Mankessim	[illegible]	40
Kikam	Western Region	27
Akomadan	Ashanti Region	60
Anum v[illegible]	Ashanti Region	100
Tanoso	Ashanti Region	60
Sata	Ashanti Region	40
Subinja	Brong-Ahafo Region	60
Bontanga	Northern Region	450
Golinga	Northern Region	45
Ligba	Northern Region	40
Tono	Upper East Region	2 430
Vea	Upper East Region	400
TOTAL		8 587

GADM
Worldmap
Google Search

Data Processing and Mapping

Sharing Data Online

Embedding Maps in Reports



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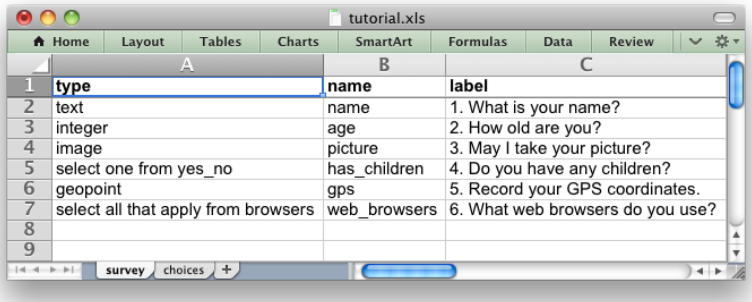
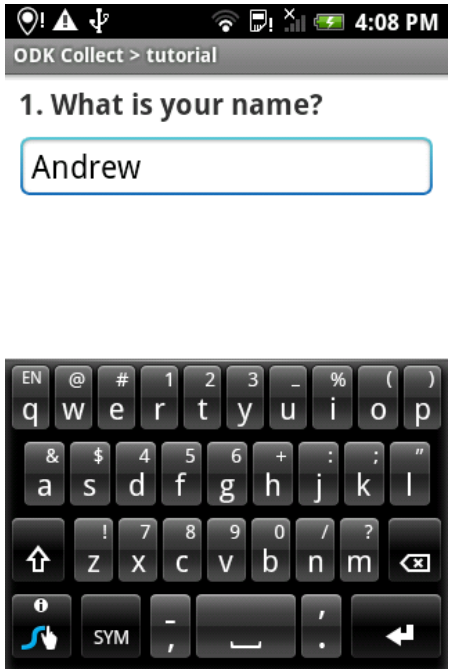
Primary Data Collection

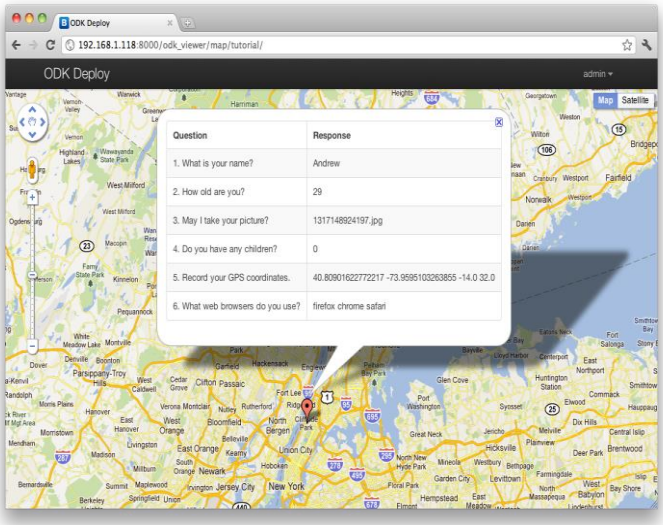


	A	B	C
1	type	name	label
2	text	name	1. What is your name?
3	integer	age	2. How old are you?
4	image	picture	3. May I take your picture?
5	select one from yes_no	has_children	4. Do you have any children?
6	geopoint	gps	5. Record your GPS coordinates.
7	select all that apply from browsers	web_browsers	6. What web browsers do you use?
8			
9			

Prepare surveys



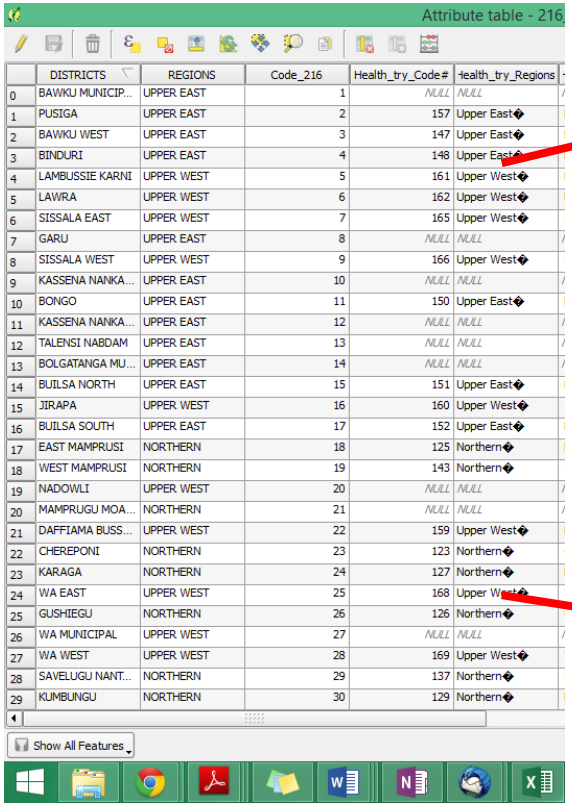
Collect data on smartphone

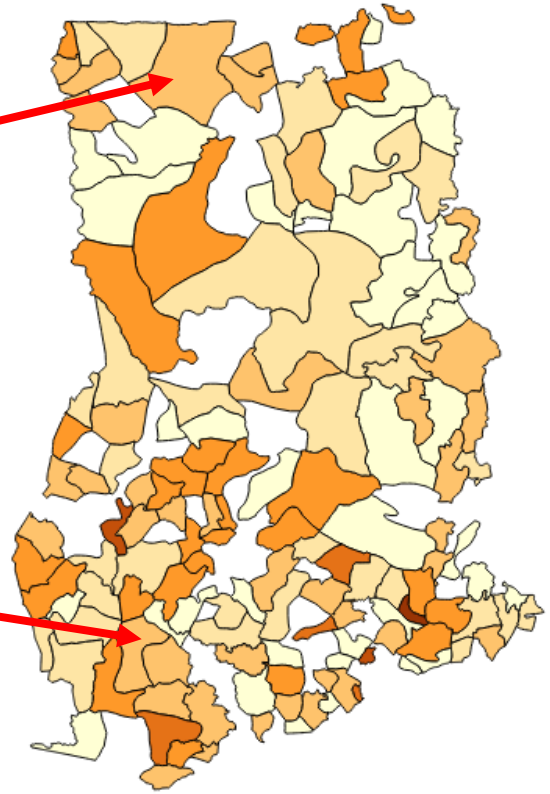


View / download / analyze data

Secondary Data Mapping

Districts	Institutional Infant Mortality Rate 2014
Adansi North	0
Adansi South	0
Afigya-Kwabre	0
Ahafo-Ano North	0
Ahafo-Ano South	0
Amansie Central	0
Amansie West	2.5
Asante-Akim Central	0.46
Asante-Akim North	11.5
Asante-Akim South	0
Asante-Mampong	0
Asokore-Mampong	0
Atwima-Kwanwoma	0
Atwima-Mponua	0.47
Atwima-Nwabiagya	0.16
Bekwai	6
Bosome-Freho	0
Bosomtwi	0

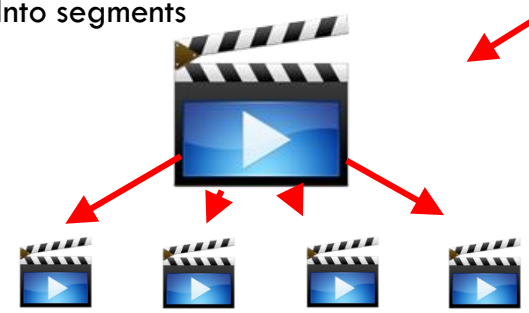




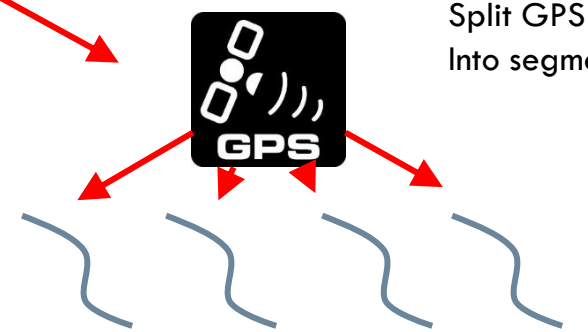
Road Quality Mapping

Contour
Split Video from GPS track

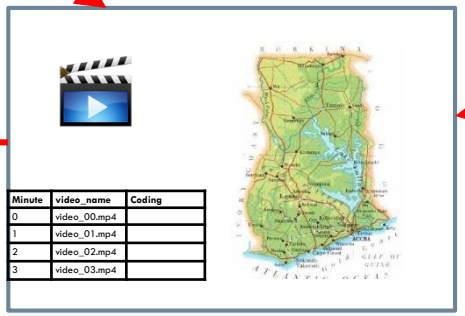
ffmpeg
Split video
Into segments



QGIS
Split GPS track
Into segments



QGIS
Code road quality



Export to Worldmap, Reports…

Minute	video_name	Coding
0	video_00.mp4	
1	video_01.mp4	
2	video_02.mp4	
3	video_03.mp4	

QGIS
Insert video segment names