CHRISTOPHER PRENER, PH.D.
SPRING, 2018

WEEK 10
LECTURE 09

INTRO TO GISc

SPATIAL JOINS

AGENDA

1. Front Matter
2. GISc & Public Policy
3. Table Joins in `R`
4. Spatial Joins in ArcMap
5. Back Matter

1 FRONT MATTER

ANNOUNCEMENTS

Midterm feedback was disseminated last week - please let us know asap if there are questions or issues to be addressed.

Lab-07 and LP-08 are due by 5pm **on Wednesday**.

Lab-08, PS-05, and LP-09 are due on **next Monday**.

Extra credit - “bounty” on typos & suggestions - see Slack for details!

New lecture repo template being used!

2 GISc & PUBLIC POLICY

3 TABLE JOINS IN R

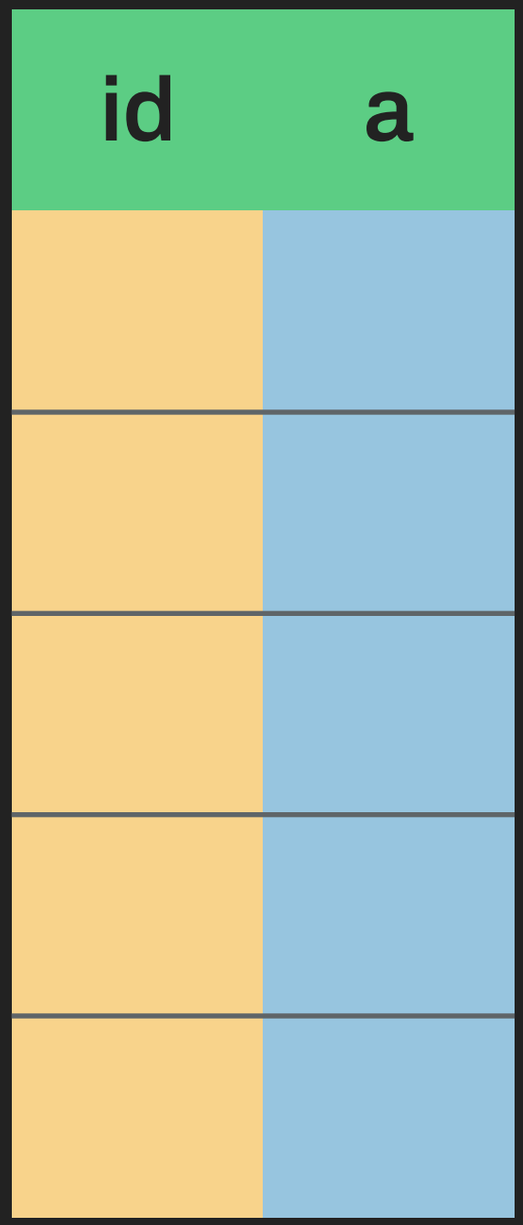
KEY TERM

Table joins are a set of techniques for combing the variables of two sets of tabular data into a single data set. They are completed based on *shared attributes*.

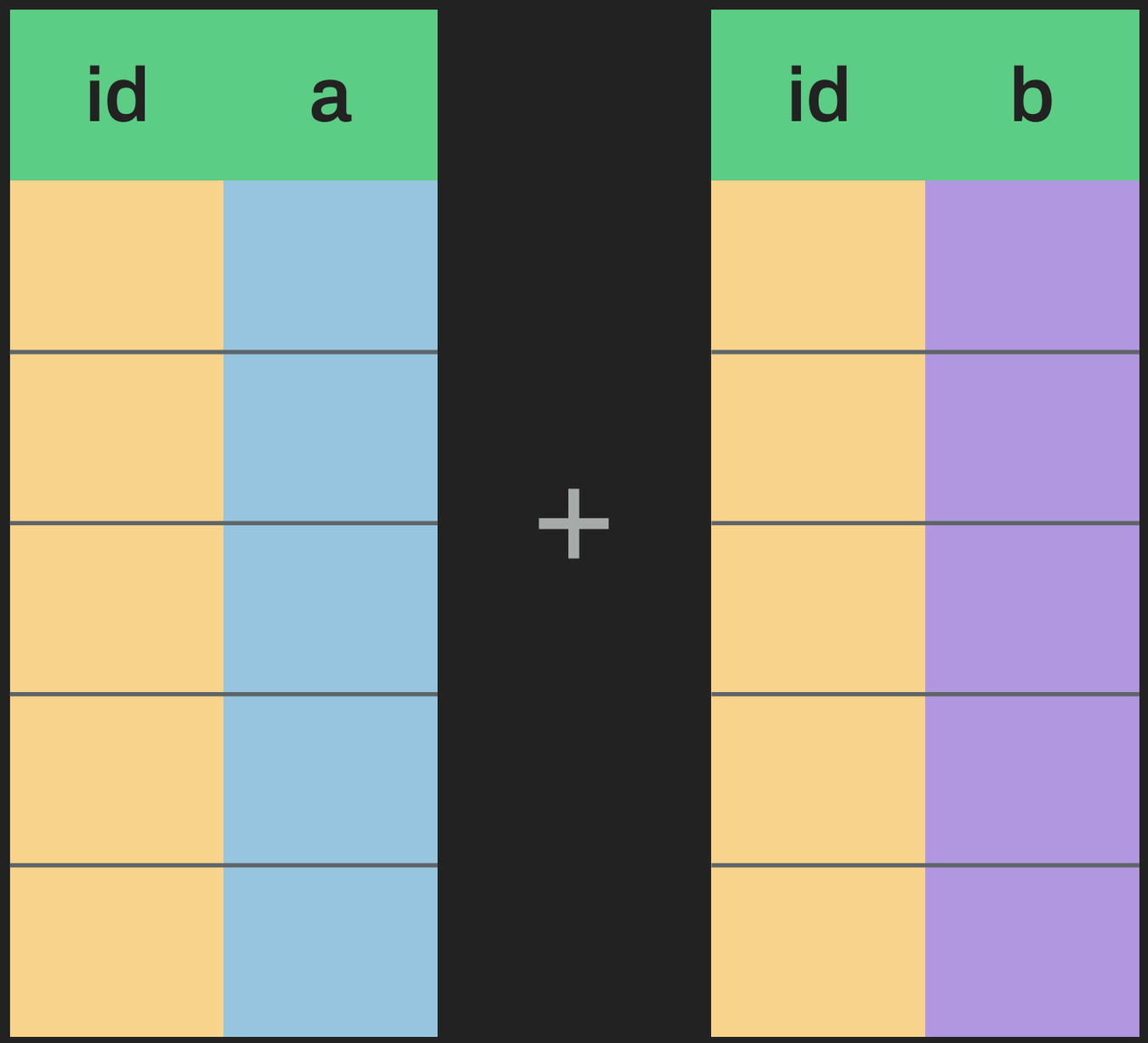
KEY TERM

A **left join** combines the variables of the first specified table with the variables of the second specified table based on a common ID variable.

CONCEPTUALIZING JOINS



CONCEPTUALIZING JOINS



CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

==

id	b
1	
2	
3	
4	
5	

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

!=

id	b
a	
b	
c	
d	
e	

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

!=

id	b
1	
2	
3	
4	
4	

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

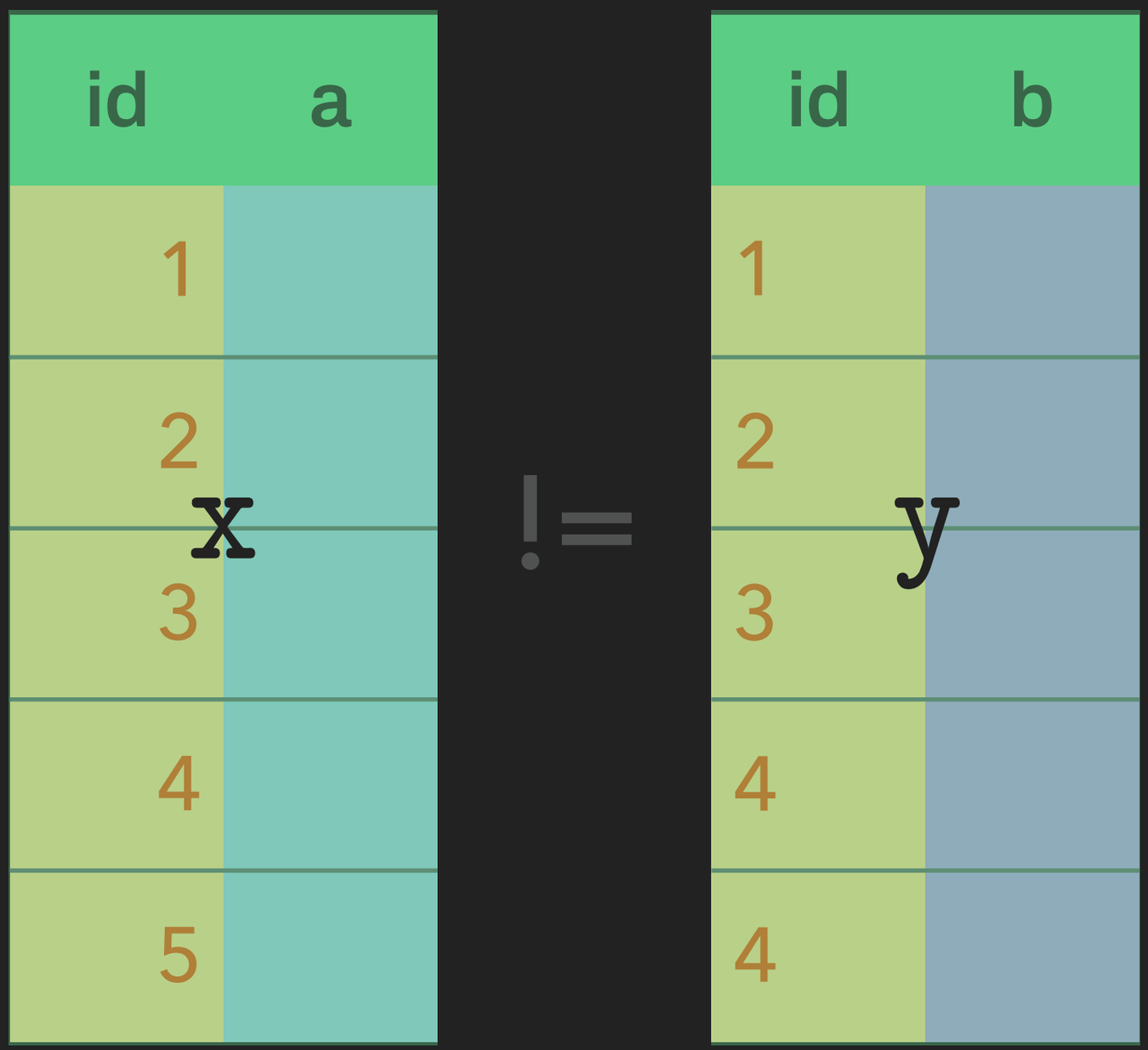
x

!=

id	b
1	
2	
3	
4	
4	

y

CONCEPTUALIZING JOINS




```
x <- mutate(x,
     as.character(id))
```

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

==

id	b
1	
2	
3	
4	
4	

```
x <- mutate(x,
     as.character(id))
```

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

x

!=

id	b
1	
2	
3	
4	
4	

y

```
y <- mutate(y,
     as.numeric(id))
```

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

==

id	b
1	
2	
3	
4	
4	

```
y <- mutate(y,
     as.character(id))
```

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

+

id	b
1	
2	
3	
4	
5	

=

id	a	b
1		
2		
3		
4		
5		

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

+

id	a
1	
2	
3	
4	
5	

=

id	a.x	a.y
1		
2		
3		
4		
5		

CONCEPTUALIZING JOINS

id	a
1	
2	
3	
4	
5	

+

id	geo
1	
2	
3	
4	
5	

=

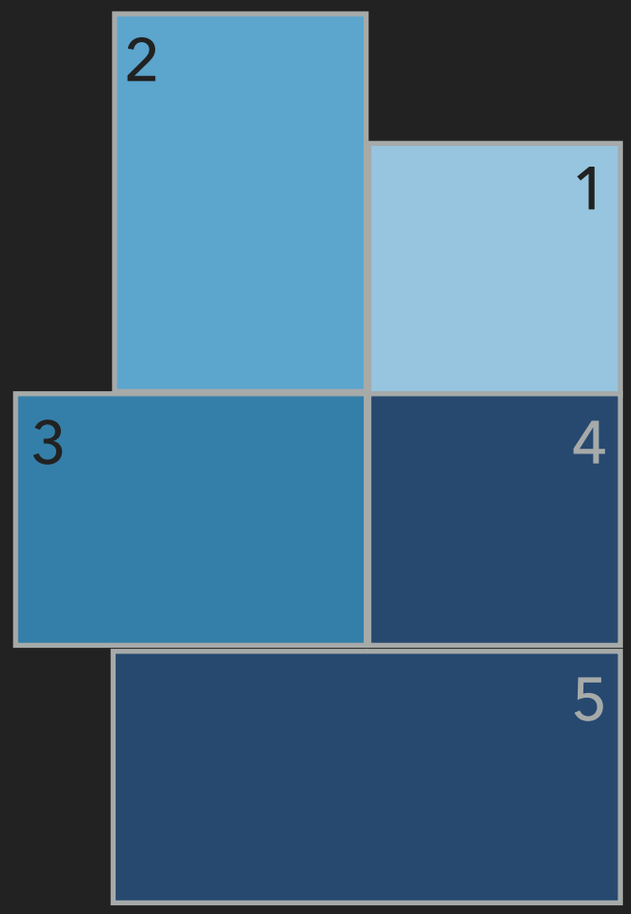
id	a	geo
1		
2		
3		
4		
5		

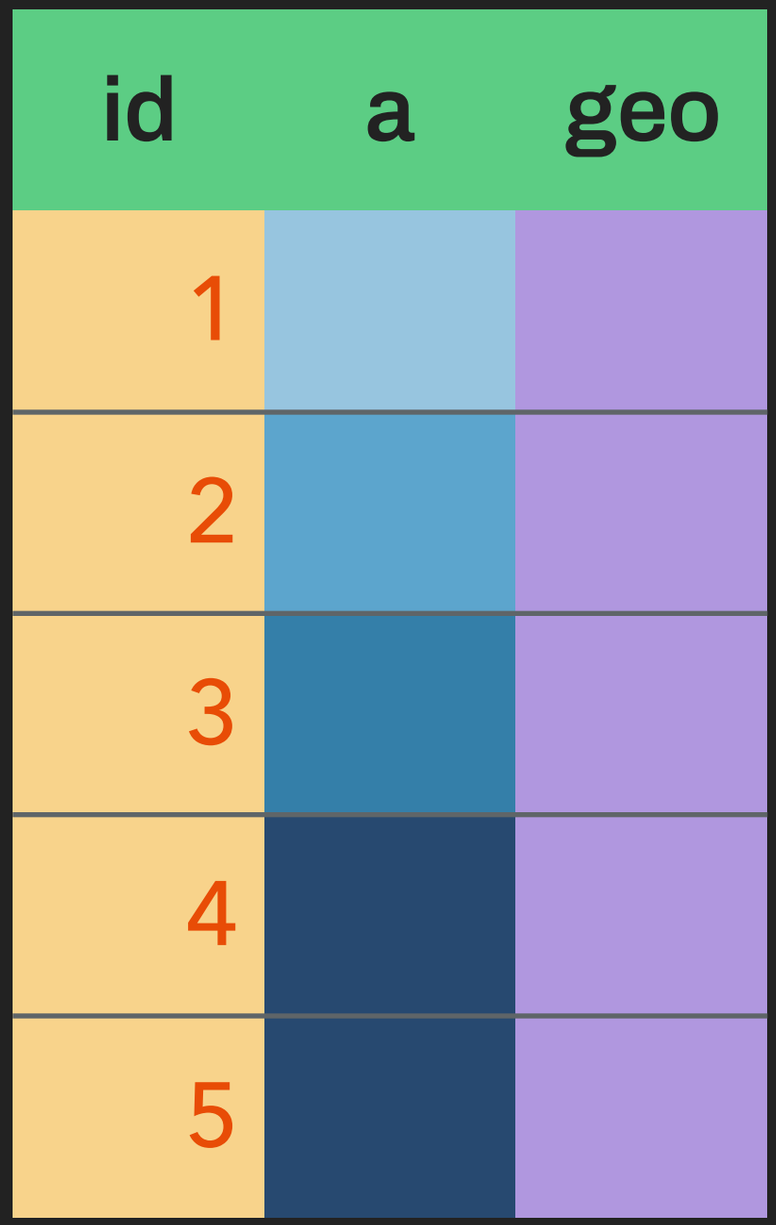
CONCEPTUALIZING JOINS

id	a	geo
1		
2		
3		
4		
5		

CONCEPTUALIZING JOINS

Use to combine tabular data with geometric data to create choropleth maps.





LEFT JOINS

f(x) `left_join(x = xtable, y = ytable, by = "id")`

Parameters:

- *xtable*
- *ytable*
- *id* is the shared identification variable

Available in `dplyr`
Download via CRAN

LEFT JOINS

f(x) `left_join(x = xtable, y = ytable, by = "id")`

Parameters:

- *xtable* is the table whose columns will appear first
- *ytable* is the table whose columns will appear second
- *id* is the shared identification variable

LEFT JOINS

```
> # example set-up
>
> library(stlData)
>
> tracts <- stl_sf_tracts
> asthma <- stl_tbl_asthma
```

LEFT JOINS

```
> tracts
Simple feature collection with 106 features and 12 fields
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: -90.32052 ymin: 38.53185 xmax: -90.16657 ymax: 38.77443
epsg (SRID):    4269
proj4string:    +proj=longlat +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +no_defs
First 10 features:
    STATEFP COUNTYFP TRACTCE       GEOID NAME          NAMELSAD MTFCC FUNCSTAT   ALAND AWATER
313      29      510  112100 29510112100 1121 Census Tract 1121 G5020        S 6936664      0
314      29      510  116500 29510116500 1165 Census Tract 1165 G5020        S  904024      0
324      29      510  110300 29510110300 1103 Census Tract 1103 G5020        S  938287      0
536      29      510  103700 29510103700 1037 Census Tract 1037 G5020        S  910953      0
537      29      510  103800 29510103800 1038 Census Tract 1038 G5020        S 1640334  35369
538      29      510  104500 29510104500 1045 Census Tract 1045 G5020        S 1939712      0
539      29      510  106100 29510106100 1061 Census Tract 1061 G5020        S  962321      0
```

LEFT JOINS

```
> tracts
Simple feature collection with 106 features and 12 fields
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: -90.32052 ymin: 38.53185 xmax: -90.16657 ymax: 38.77443
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First 10 features:
    STATEFP COUNTYFP TRACTCE       GEOID NAME          NAMELSAD MTFCC FUNCSTAT   ALAND AWATER
313      29      510  112100 29510112100 1121 Census Tract 1121 G5020        S 6936664      0
314      29      510  116500 29510116500 1165 Census Tract 1165 G5020        S  904024      0
324      29      510  110300 29510110300 1103 Census Tract 1103 G5020        S  938287      0
536      29      510  103700 29510103700 1037 Census Tract 1037 G5020        S  910953      0
537      29      510  103800 29510103800 1038 Census Tract 1038 G5020        S 1640334  35369
538      29      510  104500 29510104500 1045 Census Tract 1045 G5020        S 1939712      0
539      29      510  106100 29510106100 1061 Census Tract 1061 G5020        S  962321      0
```

LEFT JOINS

```
> asthma
# A tibble: 106 x 6
   geoID       tractCE nameLSAD                pctAsthma pctAsthma_Low pctAsthma_High
   <chr>         <int> <chr>                       <dbl>         <dbl>          <dbl>
 1 29510118100  118100 Census Tract 1181            11.9          11.1           12.7
 2 29510117400  117400 Census Tract 1174             9.60          9.30          10.0
 3 29510126700  126700 Census Tract 1267            14.5          13.5           15.5
 4 29510119102  119102 Census Tract 1191.02         9.00          8.50           9.70
 5 29510126800  126800 Census Tract 1268            9.30          8.80           9.80
 6 29510126900  126900 Census Tract 1269           13.6          12.6           14.6
 7 29510108100  108100 Census Tract 1081           12.7          11.8           13.8
 8 29510127000  127000 Census Tract 1270           12.8          11.7           14.2
 9 29510127400  127400 Census Tract 1274           12.7          11.9           13.8
10 29510103700  103700 Census Tract 1037            8.60          8.10           9.20
# ... with 96 more rows
```

LEFT JOINS

```
> asthma
# A tibble: 106 x 6
   geoID       tractCE nameLSAD                pctAsthma pctAsthma_Low pctAsthma_High
   <chr>         <int> <chr>                       <dbl>         <dbl>          <dbl>
 1 29510118100  118100 Census Tract 1181            11.9          11.1           12.7
 2 29510117400  117400 Census Tract 1174             9.60          9.30          10.0
 3 29510126700  126700 Census Tract 1267            14.5          13.5           15.5
 4 29510119102  119102 Census Tract 1191.02         9.00          8.50           9.70
 5 29510126800  126800 Census Tract 1268            9.30          8.80           9.80
 6 29510126900  126900 Census Tract 1269           13.6          12.6           14.6
 7 29510108100  108100 Census Tract 1081           12.7          11.8           13.8
 8 29510127000  127000 Census Tract 1270           12.8          11.7           14.2
 9 29510127400  127400 Census Tract 1274           12.7          11.9           13.8
10 29510103700  103700 Census Tract 1037            8.60          8.10           9.20
# ... with 96 more rows
```

LEFT JOINS

```
> class(tracts$GEOID)
[1] "character"
>
> is.character(tracts$GEOID)
[1] TRUE
>
> is.numeric(tracts$GEOID)
[1] FALSE
>
> class(asthma$geoID)
[1] "character"
```

- We can use the base R functions `class()`, `is.character()`, and `is.numeric()` to identify if the two identification variables are the same type.
- We can also do this visually, by inspecting objects in the global environment tab or using dplyr's `glimpse()` function.

LEFT JOINS

```
> class(tracts$GEOID)
[1] ‘‘character’’
>
> is.character(tracts$GEOID)
[1] TRUE
>
> is.numeric(tracts$GEOID)
[1] FALSE
>
> class(asthma$geoID)
[1] "character"
```

- Finally, we want to note if our identification variables are identically named.
- If they **are**, we can proceed with the join.
- If they are **not**, we need to modify the join syntax **or** rename one of the variables.

LEFT JOINS

f(x) `left_join(x = xtable, y = ytable, by = "id")`

Join tract and asthma data if id variables are identically named:

```
> left_join(x = tracts, y = asthma, by = "GEOID")
```

This will not work because the assumption of identically named identification variables does not hold!

LEFT JOINS

f(x) `left_join(x = xtable, y = ytable, by = "id")`

Join tract and asthma data if id variables are identically named:

```
> left_join(x = tracts, y = asthma,
    by = c("GEOID" = "geoID"))
```

This will not work because the assumption of identically named identification variables does not hold!

4 SPATIAL JOINS IN ARCMAP

KEY TERM

Spatial joins are a set of techniques for combining or summarizing the variables from two geometric data sets into a single data set. They are completed based on *spatial proximity*.

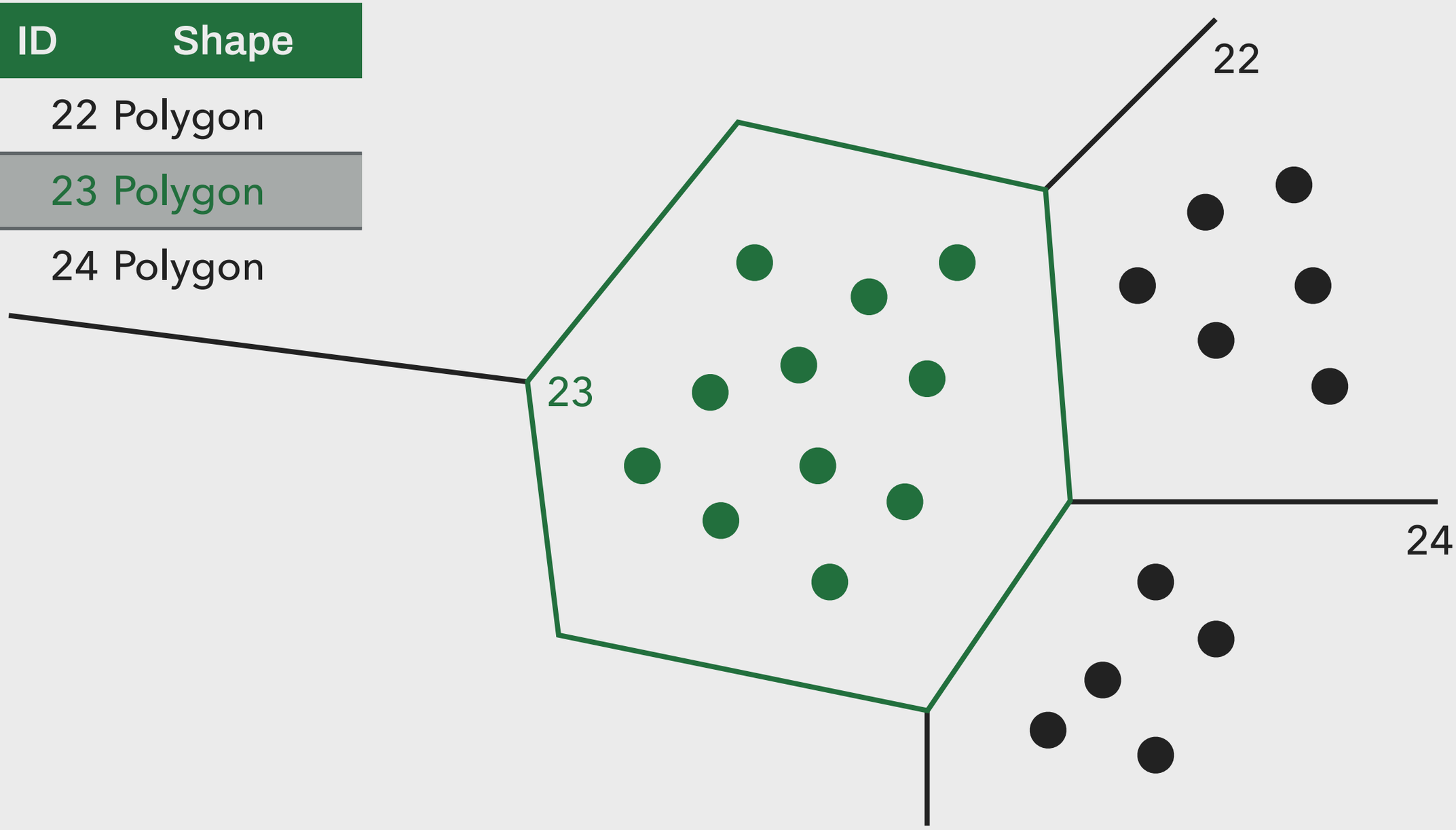
KEY TERM

A **point to polygon** join can provide a count or mean of point values that that is proximate to it.

CONCEPTUALIZING POINT TO POLYGON

Target Layer

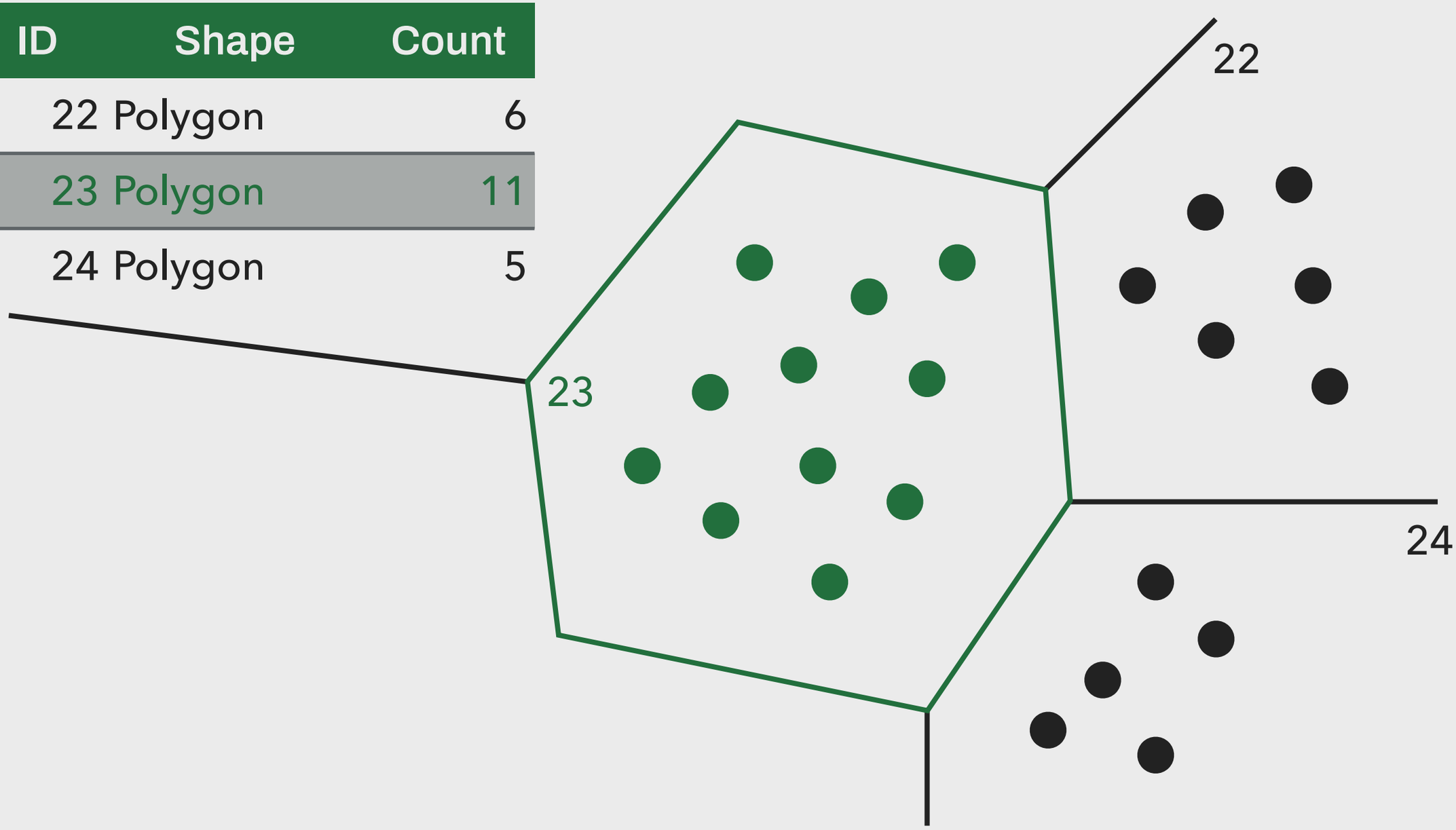
ID	Shape
22	Polygon
23	Polygon
24	Polygon



CONCEPTUALIZING POINT TO POLYGON

Target Layer

ID	Shape	Count
22	Polygon	6
23	Polygon	11
24	Polygon	5



KEY TERM

A **polygon to point** join will append the attributes of a polygon to each point that is proximate to it.

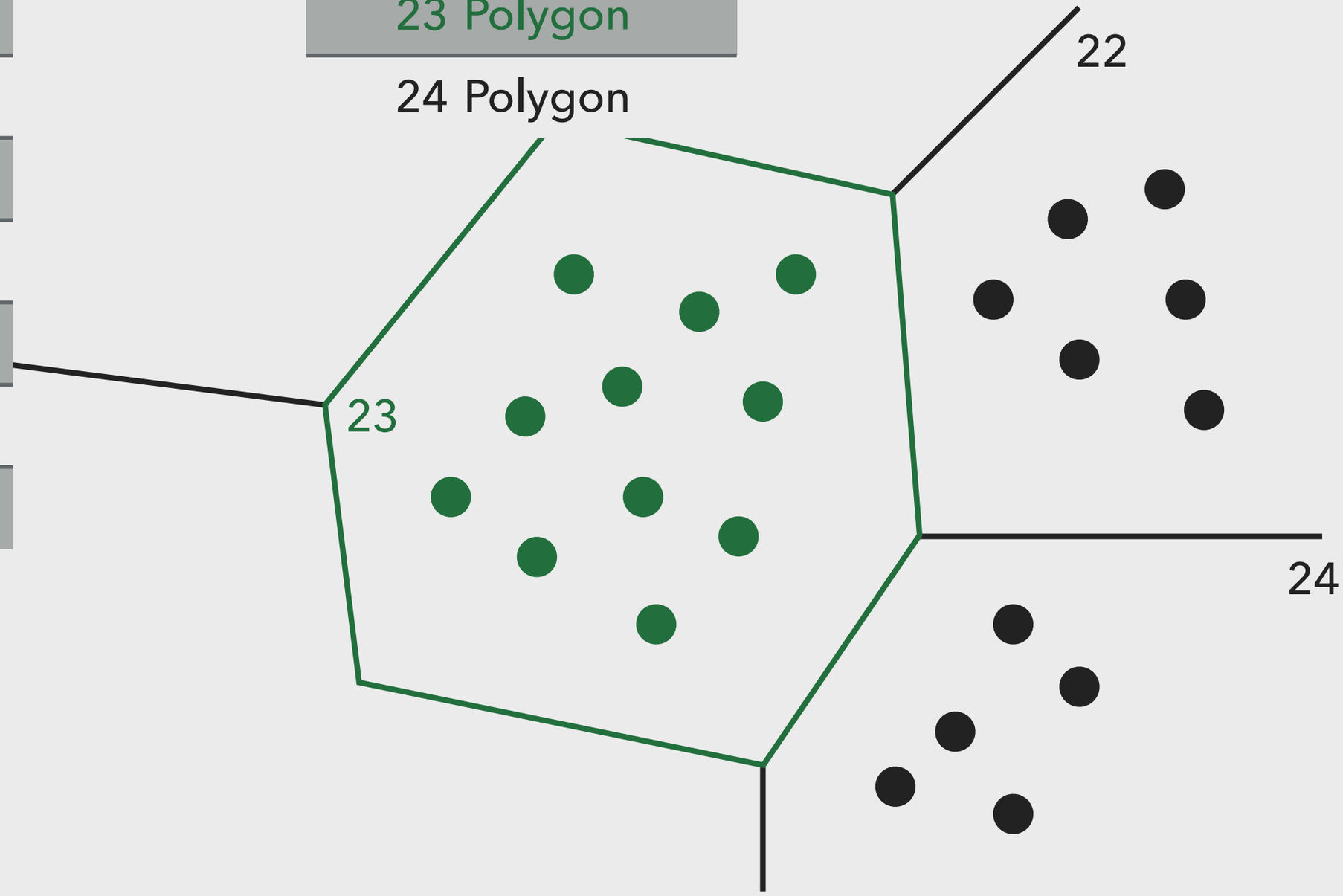
CONCEPTUALIZING POLYGON TO POINT

Target Layer

ID	Shape
104	Point
105	Point
106	Point
105	Point
106	Point
107	Point
108	Point
109	Point

Reference Layer

ID	Shape
22	Polygon
23	Polygon
24	Polygon



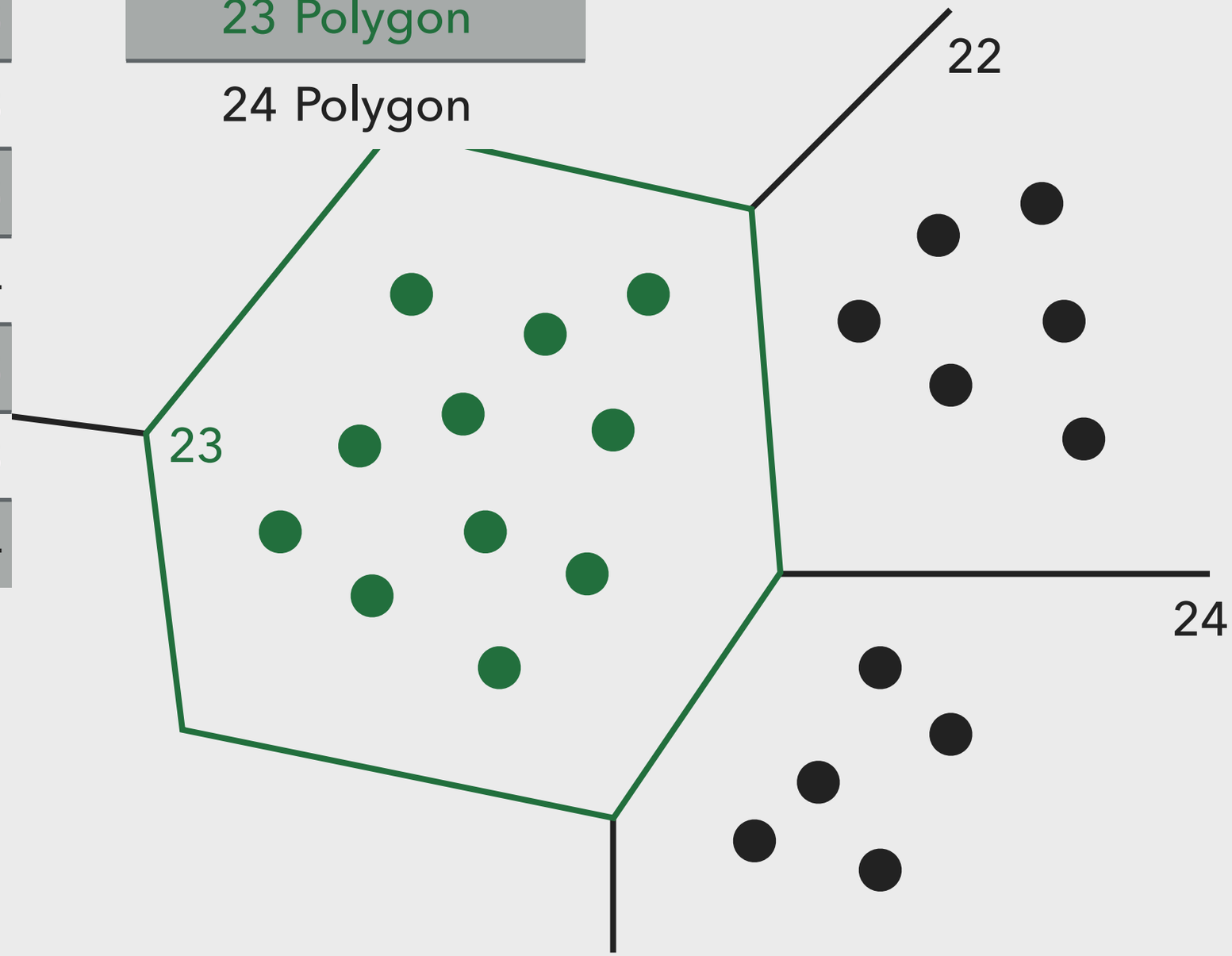
CONCEPTUALIZING POLYGON TO POINT

Target Layer

ID	Shape	polyID
104	Point	22
105	Point	23
106	Point	23
105	Point	23
106	Point	24
107	Point	23
108	Point	23
109	Point	24

Reference Layer

ID	Shape
22	Polygon
23	Polygon
24	Polygon



KEY TERM

A **point to point** join will append the attributes of a point to each point that is proximate to it.

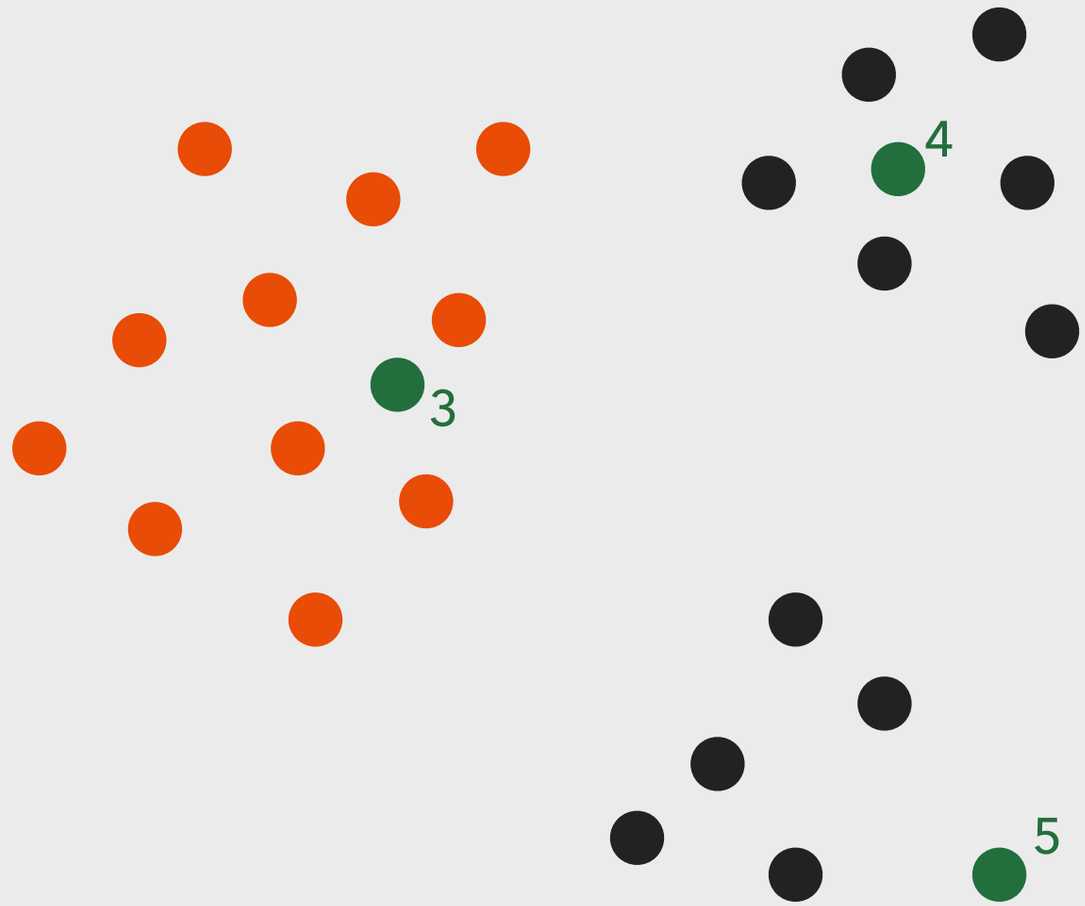
CONCEPTUALIZING POINT TO POINT

Target Layer

ID	Shape
104	Point
105	Point
106	Point
105	Point
106	Point
107	Point
108	Point
109	Point

Reference Layer

sID	Shape
3	Point
4	Point
5	Point



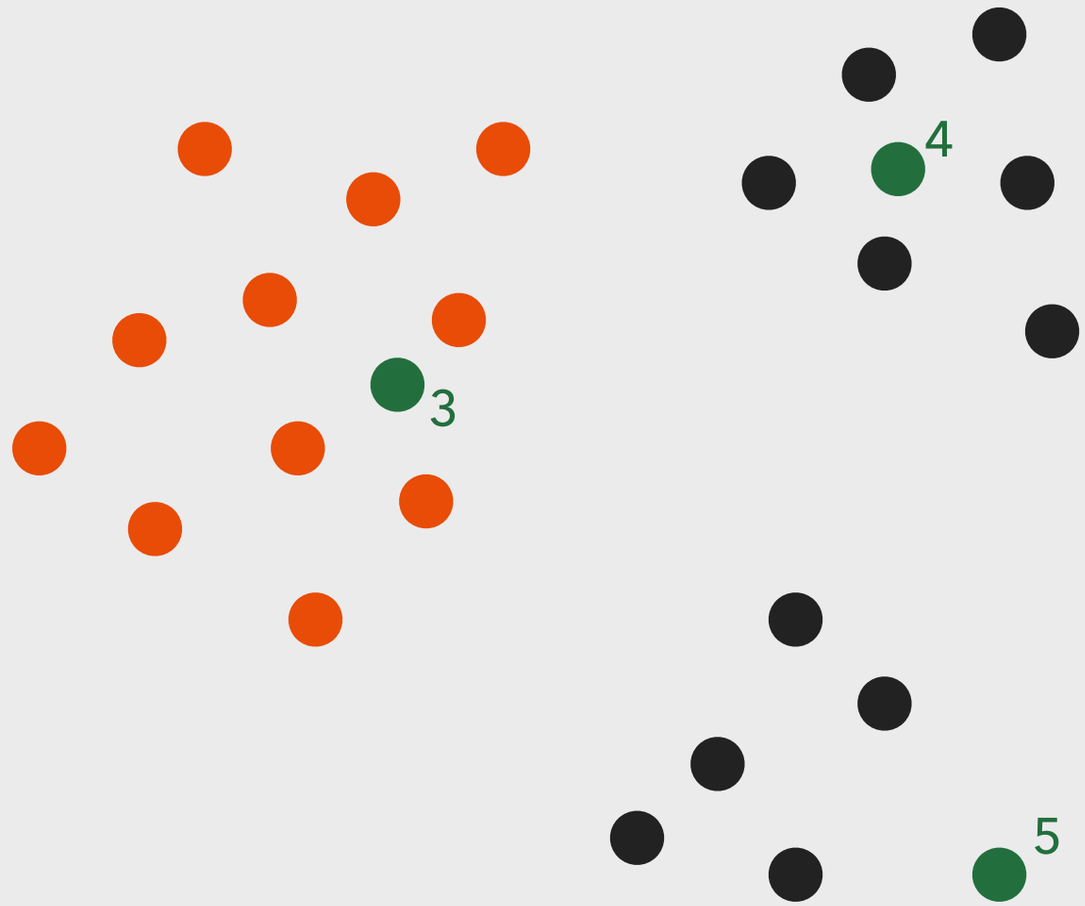
CONCEPTUALIZING POINT TO POINT

Target Layer

ID	Shape	sID
104	Point	3
105	Point	3
106	Point	4
105	Point	3
106	Point	3
107	Point	3
108	Point	3
109	Point	5

Reference Layer

sID	Shape
3	Point
4	Point
5	Point



5 BACK MATTER

AGENDA REVIEW

2. GISc & Public Policy

3. Table Joins in R

4. Spatial Joins in ArcMap

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