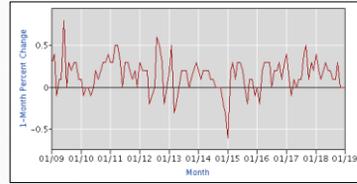


Uncertainty

- Uncertainty is an enormous challenge for business, in multiple ways
 - One area of challenge is the global and national business environment, which is inherently dynamic and unstable
 - A few examples follow from the national economy and from important national economic sectors

7

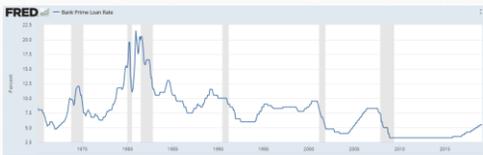
Percentage Change in U.S. Consumer Price Index: 2009-2019



Q: What does this represent? Why is this important?

8

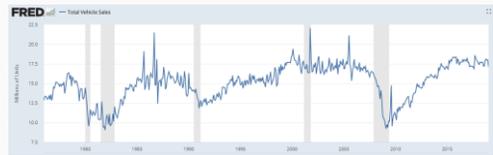
U.S. Bank Prime Interest Rate: 1970-2019



Q: What does this represent? Why is this important?

9

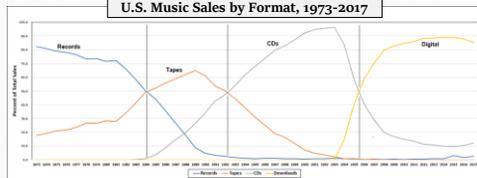
U.S. Vehicle Sales: 1976-2019



Q: What does this represent? Why is this important?

10

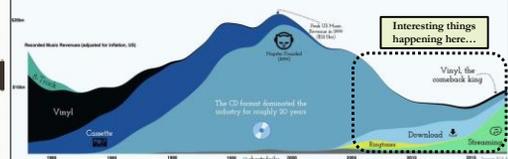
U.S. Music Sales by Format, 1973-2017



Q: What does this represent? Why is this important?

11

U.S. Music Sales by Format, 1978-2017



Another way of looking at similar data...

12

Uncertainty and Geography

- In all of the preceding examples, there are two elements that we need to consider in some way

13

Uncertainty and Geography

- The time element: each of these tracking examples show that important elements of the business environment can change and develop in new and unexpected ways
- The space element: but of course as geographers we also know that time changes like these also often have an important spatial dimension
 - Business sales** happen in specific places, and sales rates differ from place to place
 - Prices vary**, with some places being more expensive and others more affordable

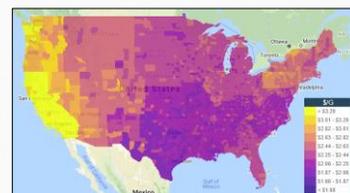
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US Cost of Living by State 2019



15

US Gasoline Price Map February 9, 2020



16

Uncertainty and Geography

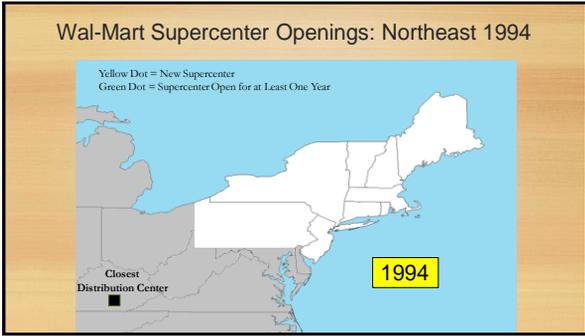
- What about space, time, and competition?
 - Q:** How can competition create unanticipated issues for a business? How can we see the impact of competition in a geographic dimension?
- One key area of challenge for business is monitoring the actions of its competition and especially accounting for the potential entry/exit of a competitor from a regional market

17

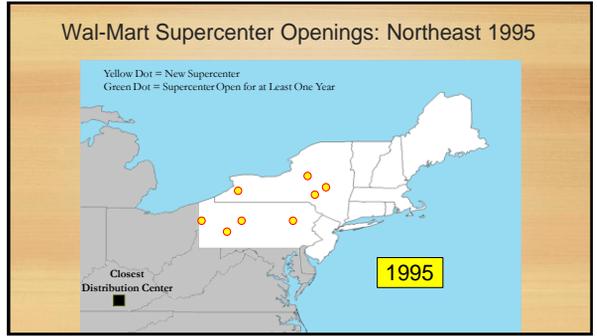
The following slides illustrate the store and distribution center opening process as Wal-Mart first entered the Northeastern Region of the US, covering the years 1994 to 2005

Imagine you are an existing retail business with operations in the Northeast as the following happens...

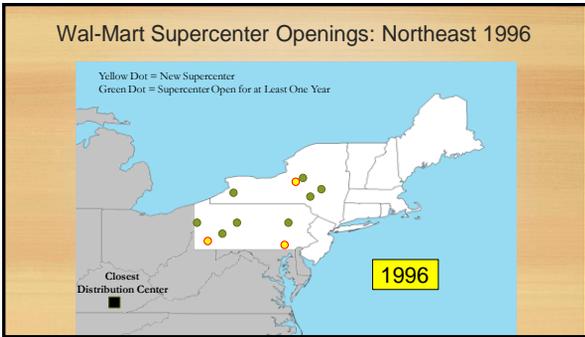
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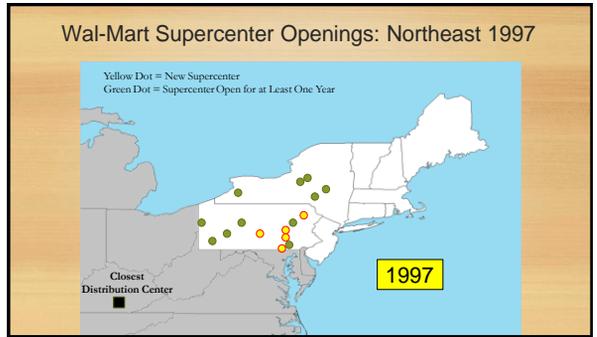
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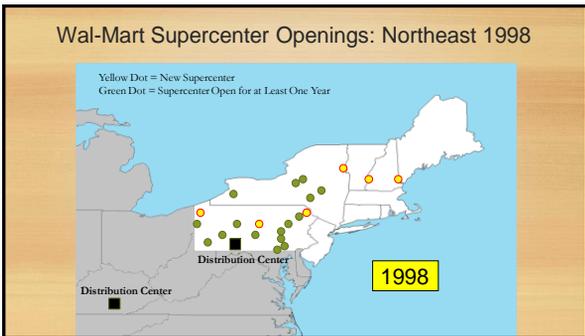
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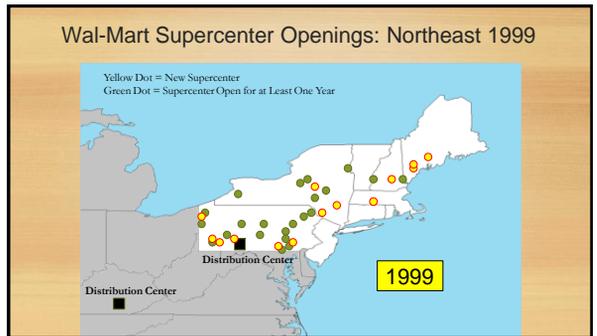
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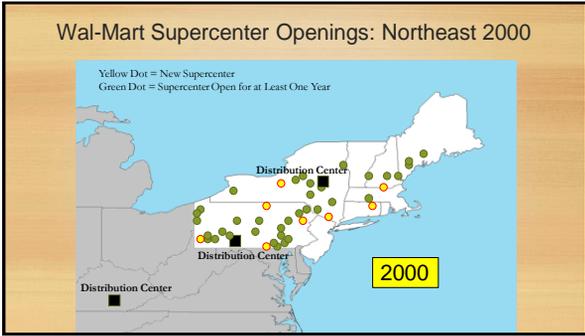
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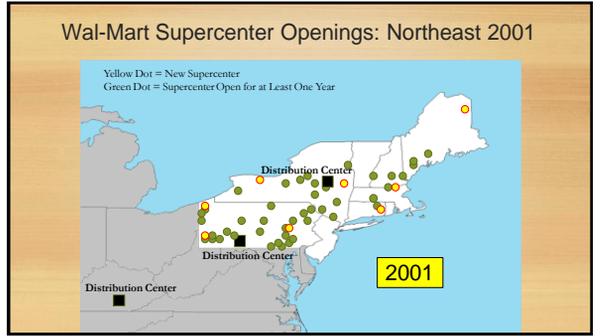
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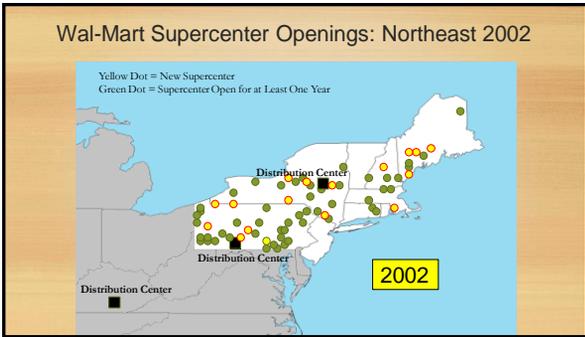
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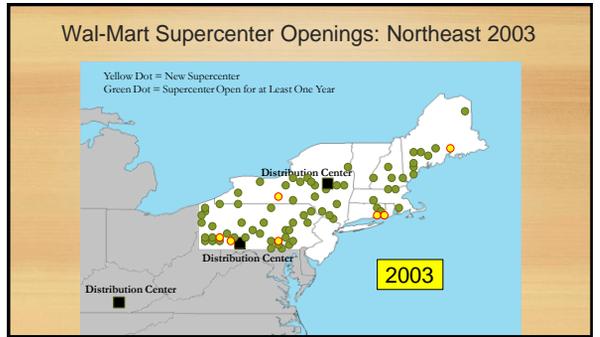
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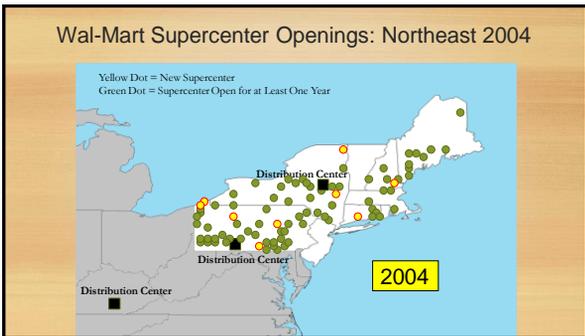
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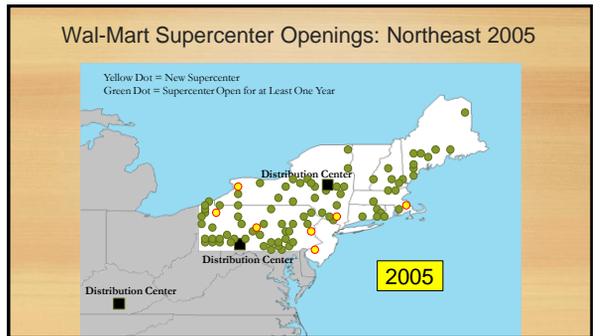
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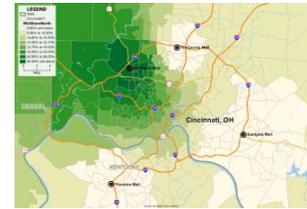
30

Q: If you were a retail competitor, what would you be thinking as you saw that unfold? What actions might you take as a result?

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The Huff Model

Applications for Market
Impact Research



32

Impact Analysis: The Huff Model

- The Huff Model is one of the best-known business analysis tools in geography that specifically exists to define an important aspect of competitive impact
 - **Goal:** to define the impact of retail competition on sales by store or by retail shopping complex within a system of existing shopping opportunities, in a given market area

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Impact Analysis: The Huff Model

- The popularity and longevity of the Huff Model can be attributed to its
 - Conceptual appeal (its basic thinking/results make a lot of sense)
 - Relative ease of use (at a basic level of application)
 - Applicability to a wide range of problems
- Predicting consumer spatial behavior is the direct application of the model
 - In the words of David Huff himself, the Huff Model is a "consumer choice model" (not a gravity model, as some have called it)

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Impact Analysis: The Huff Model

- Foundational concept: a consumer's "**perceived utility**"
 - Utility (in general): the **value** that an individual views something as having
 - In our specific case here, utility is the consumer's perspective on **how valuable or useful or attractive a store** is for them

Q: Does it make sense that some stores might have a high utility for some people, and low utility for other people? What are factors in our perceptions of utility for the stores we patronize?

35

Impact Analysis: The Huff Model

- Perceived utility varies from consumer to consumer for many reasons, but a key reason is **geographic**
 - A **store that is close to the consumer** is, all else being equal, **more valuable** or useful to the consumer than a store that is far away

Q: Do you agree with this statement? How might you explain this to someone who does not understand this concept?

36

So everything else being equal, if this is where I live, then Store A on this map is more valuable to me than Store B

As a consumer, I likely see more utility in Store A compared to B (I will shop at Store A more)

37

So everything else being equal, if this is where I live, then Store A on this map is more valuable to me than Store B

As a consumer, I likely see more utility in Store A compared to B (I will shop at Store A more)

As a business, Store A should view me as a more valuable customer than Store B (if they are the same kind of business)

38

So everything else being equal, if this is where I live, then Store A on this map is more valuable to me than Store B

As a consumer, I likely see more utility in Store A compared to B (I will shop at Store A more)

As a business, Store A should view me as a more valuable customer than Store B (if they are the same kind of business)

Q: if I am a valuable customer for Store A, what should that mean in terms of what that store should do for me?

39

Impact Analysis: The Huff Model

- The Huff Model uses this “perceived utility” concept to estimate the probability (P_{ij}) that a consumer located at place i will choose to shop at store or shopping complex j
- This probability is calculated according to the following formula:

$$P_{ij} = \frac{\left[\frac{A_j^\alpha}{D_{ij}^\beta} \right]}{\left[\sum_{j=1}^n \frac{A_j^\alpha}{D_{ij}^\beta} \right]}$$

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Impact Analysis: The Huff Model

- Let's break down the variables in this equation
 - A_j is a measure of the total attractiveness of store j (such as square footage)
 - D_{ij} is the distance from place i to store j (e.g., measured in miles)
 - The exponent α is an attractiveness parameter (estimated from empirical observation)
 - The exponent β is the distance decay parameter (estimated from empirical observation)
 - n is the total number of stores in the region being analyzed

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Impact Analysis: The Huff Model

- We'll discuss a couple of these variables in a minute, but to understand the Huff Model, it is helpful to understand the overall structure of the model itself

$$P_{ij} = \frac{\left[\frac{A_j^\alpha}{D_{ij}^\beta} \right]}{\left[\sum_{j=1}^n \frac{A_j^\alpha}{D_{ij}^\beta} \right]}$$

← The perceived utility of store j by a consumer located at place i

← The total perceived utility of all stores in the region by a consumer located at place i

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Impact Analysis: The Huff Model

- So the Huff Model could be written in basic terms as a simple ratio:



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Impact Analysis: The Huff Model

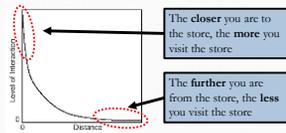
- We won't look deeply into the detailed structure of the full Huff model equation, but one important concept that drives the form of the Huff equation is the role played by exponents
 - The attractiveness parameter: the exponent α
 - The distance decay parameter: the exponent β

Let's understand the basic impact of the exponent as it operates within an equation

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Impact Analysis: The Huff Model

- Basic gravity model situation in geography



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Impact Analysis: The Huff Model

- Basic gravity model situation in geography

The exponent in the graph that defines this curve sets **how quickly the interaction falls as distance increases**



What do we mean by this?

46

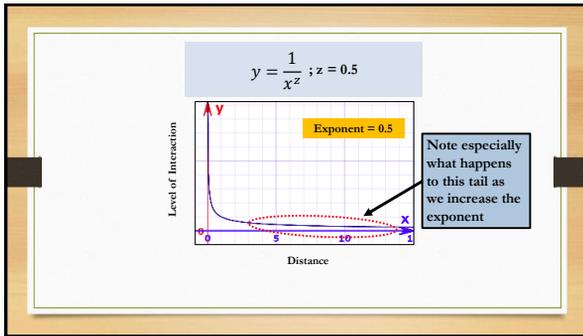
Let's look at a series of graphs that illustrate what impact a changing exponent has on an equation's output

47

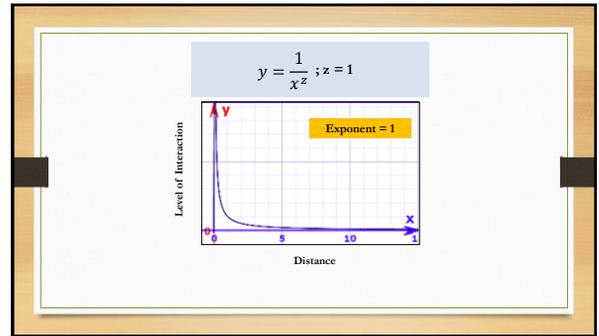
The following graphs use this simplified equation to focus on the role played by the exponent:

$$y = \frac{1}{x^z}, \text{ where } z \text{ is the exponent}$$

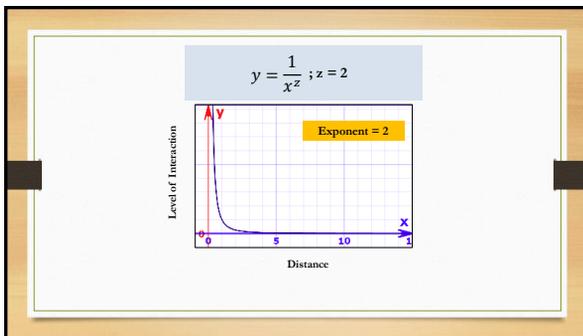
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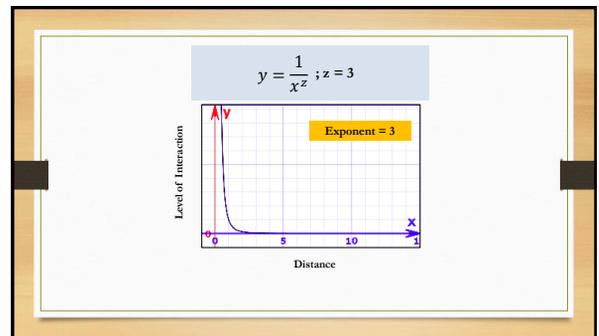
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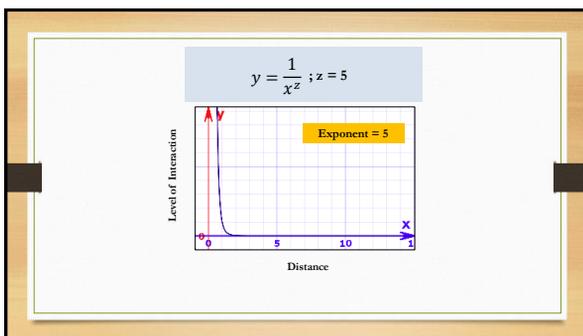
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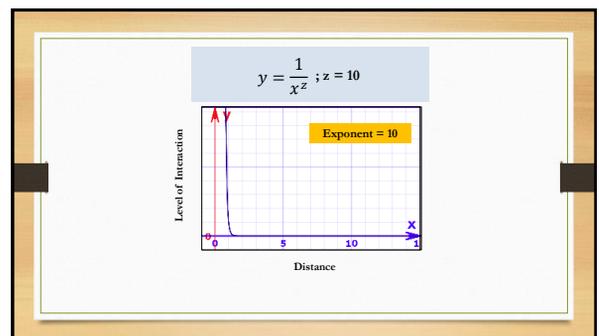
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53



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So the exponent does not change the **basic form** of the graph
But it does change the **proportions** of its features

55

With that general understanding in mind, let's look at the interpretation of the actual meaning of the **two exponent parameters** in the Huff equation

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Impact Analysis: The Huff Model

- Thoughts on the meaning of the two Huff Model parameters
 - The attractiveness parameter (the exponent α) allows us to take into account the possibility that store attractiveness might differ from one retail chain to another



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Impact Analysis: The Huff Model

Q: What might a non-linear store attractiveness relationship mean in practical terms for a given business?



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Impact Analysis: The Huff Model

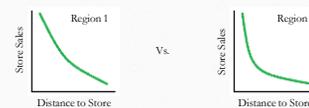
- Thoughts on the meaning of the two Huff Model parameters
 - The distance decay parameter (the exponent β) allows us to take into account the possibility that customer travel likelihoods may vary from one region to another



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Impact Analysis: The Huff Model

Q: Why might this kind of consumer travel behavior difference matter from one market to another?



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Impact Analysis: The Huff Model

- *Note:* many GIS packages do not allow for setting the attractiveness and distance decay parameters in the Huff Model (set at default values instead)
- However, Huff himself saw attention to these parameters as being crucial to the proper use of the model
 - For more parameter insights, see the online "Parameter Estimation in the Huff Model" reading (written by Huff himself, linked on the syllabus and handouts page); provides insight into the process of setting parameters and why it is often not done.
 - We can set these parameters in the Maptitude Huff Model process outlined on our YouTube videos, but for class purposes you might want to keep the analysis simple

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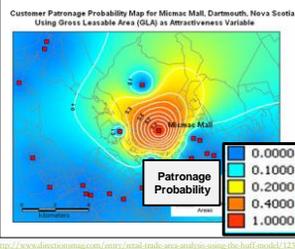
All of this calculation effort leads eventually to a pretty interesting result

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Huff Sample Result #1

Sample Huff Output Map of Customer Patronage Probability for a Shopping Mall in Metropolitan Halifax, Nova Scotia (Red = Higher Patronage Probabilities, Blue = Lower Probabilities)

From *Dramawicz Direction Magazine* reading linked on the course syllabus and handouts page



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Huff Sample Result #2

- The next few slides represent the result of a basic Huff Model analysis of market share for **major regional malls** in the **Cincinnati** metropolitan area
- This analysis was generated in Maptitude using the basic process outlined in the Huff Model in Maptitude YouTube videos (links on your syllabus and handouts page for this week)

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Huff Sample Result #2

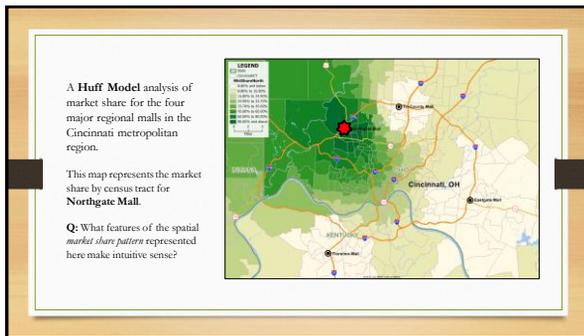
- Variables considered:
 1. **Population** by census tract (size of market in the census tract)
 2. **Distance** from each census tract to each of four major regional malls (one ingredient of "likelihood to shop": closer is better and more attractive/convenient)
 3. The **square footage** of each mall (another indicator of "likelihood to shop": bigger is better and more attractive)

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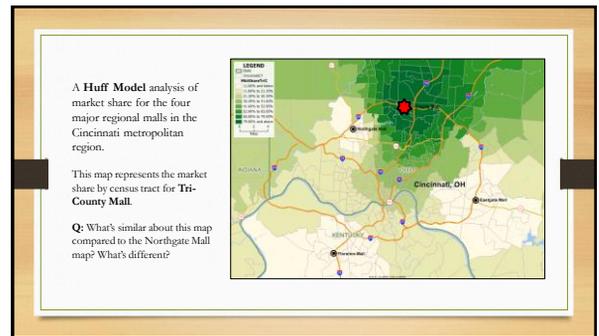
Locations of the Four Major Regional Malls in the Cincinnati Metropolitan Area



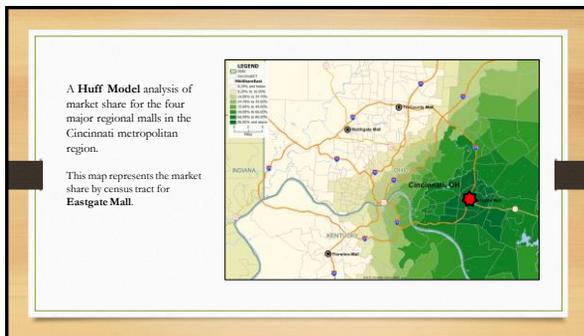
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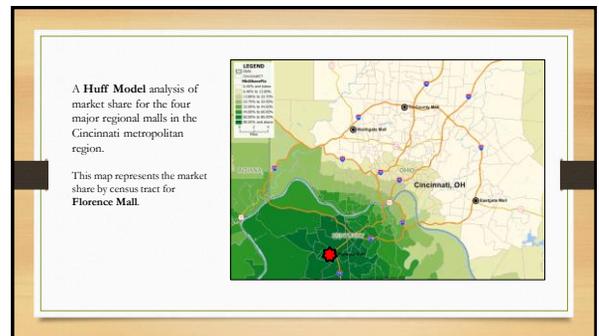
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Overall Huff Model Thoughts and Applications

- Imagine doing this, not just for an entire shopping mall, but for a chain of stores and its competition.
- Q:** What uses might we gain from such a competitive analysis?
 - In today's hyper-competitive business landscape, retailers are interested in tracking their market share and doing "what-if" analysis on a variety of scenarios
 - Example:* what if Sears closed completely? How would this impact JCPenney's market share and more general operational strategies, store-by-store and market-by-market?

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Overall Huff Model Thoughts and Applications

- Given all that we have seen, to use the model we need data representing
 - (A) **measures of retail attractiveness** for each competitor business or cluster of businesses present in a given region
 - (B) **market size measures** for communities (zip codes, census tracts) across the region
 - (C) **distance values** that define the geography of all store and consumer locations in the market area

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Overall Huff Model Thoughts and Applications

- **Q:** How might we measure “**retail attractiveness**” for a store or shopping complex? What are some possible options?
 - What about “**market size**” – are there some things about a community that we could measure and quantify that indicate how big the market is?

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Overall Huff Model Thoughts and Applications

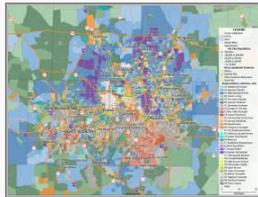
- See your “syllabus and slides” page section for this week for resources giving insight into how to implement the Huff Model analysis in Maptitude

- Week 5: Marketing Domain - Customer Analytics**
- Video: Market Analysis Using the Huff Model
 - Article: Parameter Estimation in the Huff Model
 - Video: Implementing a Huff Model Analysis in Maptitude, Part One
 - Video: Implementing a Huff Model Analysis in Maptitude, Part Two
 - Blog Entry: 10 Minutes to Use Geodemography
 - Business Website: Buxton's Customer Analytics Page
 - Esri Resource: Tapestry Reference Guide
 - Esri Resource: Tapestry Summary Tables
 - Esri StoryMap: Retail Customer Analytics
 - Esri StoryMap: Demographics and Store Performance

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Geodemographic Segmentation

Joint Analysis of Geography and Market Types



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Geodemographic Segmentation

- Another powerful application of geographic analysis in support of marketing is the field of **geodemographic segmentation**
- The *Encyclopedia of GIS* defines geodemographic segmentation as:
 - “...a range of methods used for **classifying and characterizing neighborhoods or localities** based on the principle that residents living near each other are likely to have similar **demographic, socio-economic and lifestyle** characteristics”

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Geodemographic Segmentation

- Geodemographic segmentation applications include
 - **Retail location planning:** where should a new store go, based on market factors?
 - **Service area analysis:** who lives in a given market zone?
 - **Public service targeting:** what potential needs could exist in a given area for a given kind of public service?
 - But the biggest application area for segmentation is in **targeting of direct marketing campaigns:** to which market areas should a specific marketing message go?

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One common way of analyzing and representing these market areas is via block groups.

A census block group is a geographical unit used by the United States Census Bureau.

It is the **smallest geographical unit** for which the bureau publishes sample data (i.e., data which is only collected from a fraction of all households).

In the 2010 census, there were **217,740 block groups** defined across the United States.

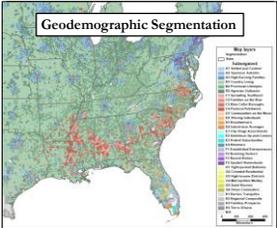
78

So geodemographic segmentation is a way of identifying the block groups that, out of all 217,740 block groups, fall into smaller groupings of very similar block groups?

Big idea: very similar block groups are not necessarily next to each other – they could be located across a metro region, state, or even the country

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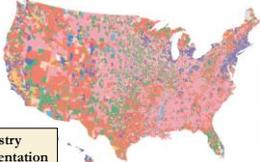
This level of complexity we are talking about across the country



80

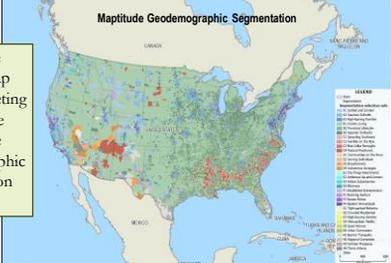
With modern segmentation, we gain a highly complex view of markets nationwide

This is Esri's Tapestry geodemographic segmentation system, mapped for the entire United States



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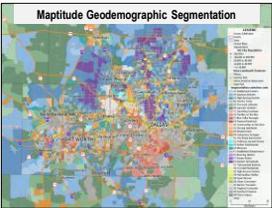
Here's the national map from a competing system, the Maptitude Geodemographic Segmentation System



82

At the city level, the results of a geodemographic segmentation cluster analysis look like this

A map of all clusters even at this level looks like a mess

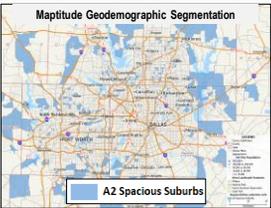


Showing the location of all segments across D-FW

83

At the city level, the results of a geodemographic segmentation cluster analysis look like this

But here's a focused view of one segment



A2 Spacious Suburbs

The "A2: Spacious Suburbs" Segment

84

This is the distribution of a very specific neighborhood type across the D-FW metroplex

Q: what's the segment pattern on this map?

A2 Spacious Suburbs

The "A2: Spacious Suburbs" Segment

85

This is the distribution of another very different neighborhood type across the D-FW metroplex

Q: what's the segment pattern on this map?

H3 Familias Prosperas

The "H3: Familias Prosperas" Segment

86

This is the distribution of one more neighborhood type across the D-FW metroplex

Q: what's the segment pattern on this map?

F4 Opulent Households

The "F4: Opulent Households" Segment

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It's also important to note that for each segment we can identify, we can also generate a very specific profile of what the households in the segment are like

F4 Opulent Households
Part of Affluent Environments

Narrative Description: Opulent Households have the highest median and mean incomes of any sub-segment in the D-FW metroplex. They are also the most educated, with a high percentage of residents holding a college degree or higher. This segment is characterized by large, high-end homes in exclusive neighborhoods.

Income Profile: A bar chart showing income distribution for Opulent Households.

Education Breakdown: A pie chart showing the distribution of education levels for Opulent Households.

The "F4: Opulent Households" Segment

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Plus we can also see where this particular segment can be found across the country

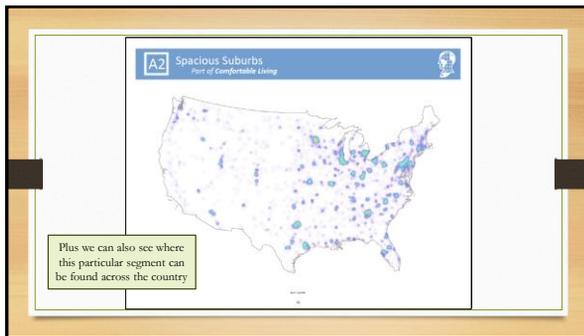
F3 Recent Riches
Part of Affluent Environments

89

Plus we can also see where this particular segment can be found across the country

H3 Familias Prosperas
Part of Cultural Mixitas

90



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Geodemographic Segmentation

- Next week's marketing GIS lab will give us a chance to see segmentation applications using Esri's *Tapestry* system in particular
 - *Focus of Tapestry:* understanding consumer behaviors
 - Tapestry segmentation divides all U.S. residential communities into 67 distinctive segments based on their socioeconomic and demographic composition
 - But which "socioeconomic and demographic" variables does Esri use to create Tapestry?

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Geodemographic Segmentation

- Here is part of Esri's statement on the variables used to create its Tapestry system:

Selection of the variables used to identify consumer markets begins with data that includes household characteristics such as single person or family, income, relationships (married or multigenerational), and tenure; personal traits such as age, sex, education, employment, and marital status; and housing characteristics like home value or rent, type of housing (single family, apartment, town house, or mobile home), seasonal status, and owner costs relative to income. In essence, any characteristic that is likely to differentiate consumer spending and preferences is assessed for use in identifying consumer markets.

Source: Esri (2017) *Tapestry Segmentation: Methodology*. Esri: Redlands, CA

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Geodemographic Segmentation

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Source: Esri (2017) *Tapestry Segmentation: Methodology*. Esri: Redlands, CA

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Geodemographic Segmentation

- Geodemographic segmentation goes so far into providing consumer insight that another new term was invented that indicates the power of segmentation to help understand consumer thinking
 - **"Psychographics":** going beyond easily measurable "census-type" factors (age, income, housing type) to address how you behave and what things are most important to you
 - How you use your non-work time, what things are a priority in your life, what kinds of music you listen to, what is your favorite kind of TV show or podcast...

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Geodemographic Segmentation

- Now, let's view one more video case study that gives us an example of how a real-world business applies segmentation and psychographics
 - Focus here: GIS applications used by Atlanta's *The Shopping Center Group*
 - Note especially the part of the video where they discuss data, and needing to do more than just providing demographic data
 - How does *The Shopping Center Group* explain the value of "psychographics"?

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