

# Rethinking Urban Space and Time through Tweets: An Analysis of Tweet Communication in Mobile Food Vending Practices

[Authors names intentionally left off.]

## **Abstract** [100-150 words]

The recent rise of food vending in U.S. cities combines physical mobility in urban space with continuous online communication. In contrast to traditional forms of urban space that have predictable and planned spatial locations, mobile food vending generates temporary forms of urban social activity mediated by websites such as Twitter. Given the unique nature of this emerging phenomenon, new forms of analysis are needed that explore and interpret online communication as a critical development in the assembly of urban social life. Using six mobile food vendors in the city of Charlotte, N.C., we apply a mixed methods approach to investigate vendors' tweet content as it informs their daily operations as well as their physical spatial and temporal sequencing throughout the city for a period of four months. We find that (1) a significant proportion of tweet content is used to announce *events*, (2) *events* are announced multiple times in a predictable time-based pattern, (3) the spatial construction of *events* is often independent of traditional urban gathering spaces in cities.

## **Keywords**

Online communication, urban space, Twitter, social media, spatial mobility

## **I. Introduction** [all text, notes, references, tables charts not to exceed 8000 words]

The proliferation of Twitter-based food vendors in many cities across the U.S., which combine physical mobility with continuous online communication, pose interesting questions about the relationship between space and information technology. In which ways does information technology inform new social practices in cities and urban space? What new spatial and temporal relationships develop as a result of information technology? How might we generate an accurate description of contemporary social practices in cities that combine with more traditional forms of urban analysis and design?

Synchronous communication, both collective and individual, has created opportunities for social encounter to occur more spontaneously and in virtually any location. Our long-term goal is to define how information technology changes our relationship to space, in particular in urban settings. This new form of urbanism should accurately describe actual behavior and will allow for planning that suits emergent behavior in an era of instant communication. In this study tweets posted on the social media website Twitter are used as a lens to better understand the role and functions of information technology in contemporary society. First, we examine how the information content of tweets is framed to advance and support the practice of mobile food vending. Second, this study analyzes how the online 'virtual' communication informs and reinvents spatial and temporal relationships in cities. We have studied this phenomenon in the city of Charlotte, NC, closely documenting and following six mobile food vendors. Using a mixed methods approach, we analyzed data about the vendors' online profile

information and tweets as well as each vendor's physical location and spatial movements throughout the city over an extended period of time.

Our hypothesis is that a contemporary theory of urban form must account for the transformation and dislocation caused by the rapid proliferation of portable, omnipresent information technology. We propose that the best theoretical structure is based on *events*, by which we mean significant urban occurrences that have both a temporal and spatial component. We also propose that this idea of events is mediated by online communication, is connected to some contemporary urban practices, and can be further organized and studied using emerging techniques in visual analytics.

While much recent work explores the online and offline social practices of activism and social movements temporarily occurring in urban spaces (AlSayyad, 2011; Harlow, 2011; Wojcieszak, 2009), little has been written about the dynamic between online and offline activity in the context of everyday urban life. Such research is important because the interplay between online communication and everyday urban activities alters and reconfigures existing patterns of use and function of urban space. Increasingly, planners and urban designers are forced to accommodate and respond to design problems and the production of urban space that is motivated by online communication (Rheingold, 2002, flash mobs, cash mobs). Few urban scholars, concerned with the production of community building and the design of social spaces, have explored online communication as a means to describe everyday urban life.

## **II. Historical Overview of Food Vending Practices**

### *History of mobile food vending*

For centuries street food vending has been a global practice. In the current era of globalization, local governments of many developing countries underscore food vendors' contribution to local economies. Concerned researchers are surveying and evaluating vending practices in multiple cultures in an effort to provide municipalities with policy recommendations to sustain and grow vending activity (Bhowmik, 2010). Studies in Indonesia, Philippines, Thailand, Bangladesh, Egypt, Senegal, and Nigeria have analyzed local economics, government support and control, women's roles, sanitation, and food nutrition among vending practices (Tinker, 1997). Researchers have performed regional studies in Latin American cities on street food vendors to develop programs with local governments to improve quality and safety of foods (Ramesh and Waghay, 2000). Embedded in the local, cultural ethos of an area, this work shows food vendors are key economic actors in various countries around the world.

In the U.S., food vending dates back to the 1700s and 1800s, but the introduction of the "Tamale men" started a vending revolution. Publicized in newspapers, plays, films and songs, Tamale men in 1890 became well known figures in American culture serving hot tamales on street corners in major cities such as Chicago, Los Angeles, New York, and San Francisco. Due to racial discomfort and sanitation concerns of citizens and governments Tamale men were largely eliminated in 1940s (Arellano, 2012). In the 1920s and 1930s, street food vendors were selling farm products, such as fruits and vegetables from horse-drawn wagons and push carts to families in neighborhoods in cities such as New York and Los Angeles. Over time, the technological developments of refrigeration, steam tables, electrical fans, and gravity fed sinks allowed for new

advancements in vending cart design. In the 1950s, push carts quickly evolved into hot dog concession carts, vending trailers, makeshift pick-up trucks, as well as highly equipped catering trucks.

In addition to technological advances in food storage and preparation, food vending in the U.S. has changed significantly due to government regulatory practices. Despite its continued developments, the tensions between food vendors and regulators of public space and health safety have maintained the same core arguments throughout time. Regulators and some public adversaries argue that vendors congest streets, weaken business for brick and mortar establishments, contribute to crime, and use unsafe food practices. These arguments have weakened the potential growth of food vending. On the other hand, cities may benefit from positive vending models, such as those established in the city of Portland, where food vendor's are known to build community in neighborhoods and cities, provide access to food in areas with few options, promote entrepreneurship, and create jobs in a down economy (Kapell et al., 2008).

### Contemporary food vending

Today, many vendors roam the streets of most U.S. cities in what are commonly referred to as gourmet mobile food trucks. At a basic level, these mobile vendors are defined by their high-quality and often high-priced food served in stylishly branded and fully equipped catering trucks to patrons desiring a new type of outdoor food experience. They also use various forms of information technology to communicate and exchange real-time information as well as to mobilize their business and activate urban areas with a predictable crowd.

The unprecedented growth of contemporary mobile food vendors can be linked to the economic downturn of 2008, the explosion of social media platforms, smart phones and global positioning applications as well as the ever-popular Los Angeles-based Kogi food trucks, most well-known for serving a fusion of Korean-Mexican tacos and becoming as an inspiration to food truck entrepreneurs nationwide. After the economic decline, skilled, culinary entrepreneurs wanting to start their own restaurant, or who had difficulty maintaining an existing restaurant, found starting a mobile food business to be more financially feasible and flexible.<sup>1</sup> These mobile food vendors quickly discovered operating in urban areas to be relatively easy given the lack of prior mobile vending precedents and loose municipal ordinances.

In September of 2012, the U.S. Small Business Administration, the government's official website for small businesses, created a page with "Tips for Starting your Own Street Food Business" in response to the rapid growth across the nation. While the exact number of mobile food vendors in the U.S. is undocumented, a small business report conducted in 2012 estimates the food truck industry to gross \$2.7 billion dollars by 2017, a fourfold increase from 2012 (Emergent Research, 2012).

### Media ecology of food vending

Contemporary mobile food vendors take advantage of the speed and usability of information technology to promote, connect and expand its operations across cities and regions. For instance, food vendors, customers, and supporting organizations use social media platforms (e.g. Twitter and Facebook), smart phone applications that offer real-time tracking of food trucks (e.g. TruxMap, Food Truck Fiesta, Road Stoves GPS and

Truck Spotting), smart phone payment applications (e.g. Intuit's GoPayment and Square), photography and video platforms (e.g. Instagram, Vine) as well as blog, business and food review websites (e.g. MobiMunch, Yelp and Urbanspoon). These tools, which together create a media ecology, assist in the meeting of customers and food trucks in a variety of locations.

### *The rise of Twitter and its role in food vending*

Of these various information technologies, the social media website Twitter quickly became the most popular among vendors. Structured on a microblogging framework that allows sending of 140 character messages or 'tweets', Twitter is a San Francisco-based company founded in 2006 with just 20 users and today has grown to roughly 500 million active users as of July 2012 and approximately 140 million of these users are in the U.S. (Semiocast, 2012).

Small businesses have realized the benefits of using Twitter's platform to expose their services. Vendors find Twitter to be a useful and free mass-marketing tool to communicate to a localized audience their latest or future locations in a city, daily or hourly menu items, or if they are sold out or out of service. Aside from promoting their business, vendors also use Twitter to strategically choose locations to serve on their daily route. For instance, vendors find it convenient to check tweets to understand the locations of their fellow food trucks to avoid an overlap of vendors at the same location. Customers, on the other hand, find this real-time information convenient to know the whereabouts and menu items of their favorite or new trucks. It is no surprise Twitter provides a virtual infrastructure for communication in an industry reliant on mobility. The effects of real-time information have assured vendors a constant and sufficient customer base in a variety of public and privately owned locations, such as plazas, community parks, tourist areas, corporate office parks, college campuses, parking lots and alleyways. As customers instantly populate these locations for temporary periods of time, urban spaces acquire new functionalities and meanings.

### *Overview of Food Vending in Charlotte*

The city of Charlotte recently witnessed the rise of Twitter-based gourmet mobile food vending in 2012. Although the city's vending practices are relatively new and the number of vendors is fewer than major U.S. cities, its emerging scene provides a rich social, cultural, and economic set of urban conditions. As of 2013, 125 mobile food units and 56 single operator push carts have registered health permits in Charlotte-Mecklenburg County (Charmeck.org). Push carts primarily serve on sidewalks in the downtown area and mobile food trucks serve at locations outside of the downtown area.

In 2008, the City of Charlotte, concerned with the growth of vending in other cities, sought to revamp its food vending ordinance with strict controls on public right of ways. Among many regulations, the most impactful limit the number of days to serve at a single location to 90 per year, limit the hours of operation from 8:00am to 9:00pm, require 400 feet separation from another vendor and residential zoned districts, and restrict vending entirely on streets in the central business district. At the time, long established taco trucks or Loncheras operated by Hispanic or Latinos regularly parked near residential neighborhoods and felt the new regulations directly attacked their established 50 vendor community. From this policy change emerged concerns about

social injustice in a regulatory system that governs a city where the three largest populations consist of White (50%) Black or African American (35.0%) and Hispanic or Latino (13.1%) (U.S. Census, 2010). In an attempt to change what felt like a discriminatory act against their business and community the vendors petitioned to amend the ordinance, but achieved little success. While the taco trucks today have weakened, the gourmet food trucks have expanded, following carefully made business plans to aggressively locate new locations and arrange new property agreements.

### **III. Digitally Networked Space**

Today, the increased use of information technology has transformed the understanding of time and space. Historically, cities were viewed as concentrations of communication and information exchange, with propinquity as a central measurement of economic prosperity. Spatial concentration was understood as vital to overcoming time delays that constrained communication and the movement of goods and services. With the widespread acceptance of the Internet and the personal computer in the early 1990s, online communication has changed these dynamics. Limitations of time are now minimized through the ability to transfer information instantaneously, which has led some futuristic dystopian theorists to question the relevancy of cities and city space. Some scholars suggest that reduced face-to-face contact, home employment, and infrequent automobile travel diminish the economic value of place (Mason and Jennings, 1982; Negroponte, 1995; Pascal, 1987). On the contrary, theorists propose that propinquity continually bears significance in an electronically mediated world (Graham and Marvin, 1997). In fact, they claim that information technology breeds intensification of urban activity through both electronic and transportation networks. Regardless of their opposed viewpoints, they do allude to an important question regarding place in the 21<sup>st</sup> century: As information technology reconfigures the particulars of time and space in our society, how will cities and urban space acquire new uses and meanings?

#### *Discourses about Information and Society*

As early as 1964, urban theorist Melvin Webber in “The Urban Place and the Nonplace Urban Realm” set the stage to rethink the dynamics of communication and urban spatial arrangements in cities by acknowledging the emergence of new social relations dependent on public communication and interaction that transcends place. While at the time revolutionary, Webber foresaw public communication channels, such as electronic transmission devices (i.e. telephones), mass communication (i.e. radio and television), and face-to-face communication, to be indicators of cultural development which can be used as devices for evaluating the effectiveness of plans and programs for urban spatial structure. Overcoming prior fixed notions of spatial and temporal relations, Webber asserted that accessibility, rather than propinquity, would become the necessary condition of place. He believed that as accessibility became further freed from propinquity, cohabitation of a territorial place (i.e. neighborhoods, suburbs, or cites) was less important to the maintenance of social communities. Ultimately, he argued we should examine interest communities (i.e. new urban realms) derived from communication channels of similar interests where spatial distribution was not the crucial determinate of membership, but rather interaction.

A useful framework to begin our analysis is Stephen Graham's outline of three theoretical discourses about information technology and society. These are labeled as 'substitution and transcendence', the 'co-evolution' perspective, and the 'recombination' perspective (1998). Substitution and transcendence or technological determinism follows the logic that technologies are assumed to directly cause social and spatial change in cities. Similar to theorists who questioned the future relevancy of space, these scholars 'cast technology as an essential and independent agent of change that is separated from the social world and impacts it' (1998, 168). While this perspective has a long lineage in urban discourse, we find its Utopian predictions to overly deterministic and neglect the embeddedness of human life in space.

Graham's co-evolution perspective more aptly addresses the linkages between place-based and electronically mediated realms in contemporary cities. In opposition to determinist views, it acknowledges that the human construction of space and place can actually ground and contextualize uses of technologies. Here, 'materially constructed urban places and telecommunications networks stand in a state of recursive interaction, shaping each other in complex ways that have a history running back to the days of the origin of the telegraph and telephone' (1998, 174). This perspective considers the mutual and complex relationships between our everyday lives and our electronic encounters as a 'state of suspension' or evolution were new technologies diffuse into the older urban fabric offering potential for doing things in new ways, rather than simply substituting or revolutionizing the city (173).

Graham's third discourse, the 'recombination' perspective, anchored in the actor-network theory of Michel Callon and Bruno Latour (Latour, 2005), suggests agency is purely a relational process containing multiple, heterogeneous networks. Information technology becomes closely enrolled with human actors into systems of sociotechnical relations across space. Here, space and time as well as human interaction, control, and organization are continually constructed and relational, rather than absolute. As Graham highlights 'the merit of the actor-network perspective is the way it articulates human-technological recombinations and relationships through a rich, contextual, mapping which avoids essentializing sociotechnical relations' (1998, 180). We find this approach useful in addressing how technologies have contingent effects through the ways they become linked to specific social contexts by combining human and technological agency.

Varnelis and Friedberg describe how pervasive digital networks are reconfiguring our relation to place by enabling simultaneous presence in both physical and networked place. Their work explores the 'networking of space and the spatiality of the network, identifying a series of key conditions: the everyday superimposition of real and virtual space, the development of a mobile sense of place, the emergence of popular virtual worlds, the rise of the network as a socio-spatial model, and the growing use of mapping and tracking technologies' (2008, 15). In each of these areas 'information is less the product of discrete processing units that of the outcome of the networked relations between them, of links between people, between machines, and between machines and people' (Varnelis, 2008, 146). In short, their perspective of 'network culture' suggests that inhabiting localized time and space is in a process of deep transformation as we are co-present with others and information.

Similarly, Castells developed a theory of networks in the Information Age he calls 'space of flows'. For Castells, space is the material support of time-sharing practices and

cannot be placeless. Flows refer to the flows of capital, information, technology, organizational interaction, and images that our society is constructed around. In the informational society, the space of flows is the material form of support of processes and functions, 'it is where the dominant functions take place in our societies made possible by information technology devices' (2000, 442). In this network, places are defined by the exchanges of flows in the network. Thus, 'the network of communication is the fundamental spatial configuration: places do not disappear, but their logic and their meaning become absorbed in the network' (2000, 443). Much like the co-evolutionary perspective, Castells' account of contemporary society acknowledges the interconnected nature of place and networked communication.

#### **IV. Mixed-method approach**

This study uses a mixed methods approach to understand the ways mobile food vendors communicate through social media and their shifting operational settings across cities. Methods of analysis include statistical analysis of the frequency and content of tweets, topic modeling of the content of tweets, ethnographic studies of the operation of the vendors, and documentation and mapping of the spatial and temporal sequencing of each vendor throughout the city.

To start, six mobile food vendors who used Twitter for their business were chosen for the study based on the number of 'followers' (> 1,000) tallied on each vendor's Twitter webpage. Each food vendor was interviewed on two separate occasions. These interviews covered topics ranging from: length of time in the business, operating methods for each vendor, approach to the use of Twitter, scheduling procedures for events and locations, and feedback from customers, types of menu items with regard to location or time. Each vendor was visited during at least three locations. At these visits, diagrams of the arrangement of the trucks and the locations of customers over time were recorded. Both photographs and time lapse video were collected for each event. Additionally, a small sample of customers were informally interviewed, with particular emphasis on the role of Twitter in their decision to attend the event.

For each location, site plans at two scales were generated: one scale included immediately adjacent buildings and other site elements, the other scale included an approximately two block radius from the event. These site plans were orthographic constructions of the type typically used in urban design methods. The smaller scale plan was useful in understanding the relationship between the truck and the customer and any other co-located trucks. The larger scale helped to provide a framework for understanding the place of the truck with the urban context of nearby land and building uses.

The primary data collected for the online study consisted of 1,000 tweets over a period of four months from each of the six vendors. An application programming interface (API) was used to collect the tweets from Twitter's website and placed into a spreadsheet document. Each tweet in the data set included the vendor's account name, date of tweet, time of tweet, number of retweets for a tweet, and the content of tweets themselves.

#### **V. Discussion**

*Communicating Event Space: Tweet Cluster Analysis*

The research effort began by examining the content of vendor's tweets using a simple automatic topic analysis. This effort is complementary to the qualitative analysis we do elsewhere, providing a set of topics that naturally emerge from grouping verbally similar tweets together.

Text analysis of tweets is difficult using traditional automated topic analysis methods due to the short length of documents, heavy use of slang and abbreviations, and noise from URLs, attached images, and automated tweets from applications. Therefore, we used a simple topic analysis method based on k-means clustering. More sophisticated methods such as Latent Semantic Analysis (LSA), did not produce better results with our data, likely because the short length of the documents violates the assumptions of these methods.

We first simplified the tweet data by extracting the most frequent 1000 keywords minus a standard list of *stop words*, or words to ignore (e.g., overly common words such as *the, an, of*), augmented with tweet-specific stop words including *RT, #*, and URL components such as *http* and *t.co* (the standard beginning of a URL automatically shortened by Twitter). These 1000 keywords become dimensions in a transformed dataset. Instead of being a string of words, each tweet is a vector of zeros (does not contain the keyword) and ones (contains the keyword). This is known as a “bag of words” technique since the order of words is ignored. This results in a dataset in which each tweet is a point in a very high-dimensional space.

We then performed k-means clustering using the Euclidean distance between the vectors that represent the tweets. K-means clustering takes a number of clusters as an argument and classifies data items according to the tightest clusters when the space is separated into that number of groups.

We ran the analysis with values of K ranging from 4 to 10 clusters and examined the results by hand. Based on the qualitative results of interviews, the topics produced by the eight-cluster analysis were judged to be the most meaningful. While this is a subjective judgment, there was a great deal of consistency between the analyses, so this choice does not significantly affect our results.

The eight clusters in the final analysis are summarized in the following table (Figure 1). The top ten features for each cluster are listed, along with the number of tweets in the dataset which are classified as part of the cluster. The titles were determined subjectively. The largest cluster, which we labeled “Miscellaneous,” is not a clearly defined topic and contains a number of generic terms found in other clusters. This was a common feature to all of the topic analyses we produced and is likely related to the fact that many tweets are difficult to classify due to their noisiness and the small number of words in the classification.

The other seven clusters reveal more meaningful patterns that relate to the trends we saw in interviews and the on-site qualitative analysis. For instance, tweets about a truck's schedule are the second most common cluster, and clusters of tweets about locations, menu items, and gratitude towards customers are also apparent. The analysis also reveals more specific patterns. For example, the “Food Truck Trend” cluster, which contains a mix of hashtags, mentions, and words relating to the phrase “Charlotte food trucks,” is related to trending topics about food trucks that emerge around events. The cluster “Truck Mentions” cluster, which includes truck user names preceded by the @ sign and is used to mention or reply to another Twitter account holder, suggests a



dialogue of communication occurs between vendors and customers. The cluster “Food Truck Friday” contains a series of terms such as rally, Friday, and Southend that relate to topics about a large event that takes place every Friday. The clusters “Schedule” and “Location” include terms about time and location-based information which are necessary aspects of businesses reliant on mobility.

	Miscellaneous	Schedule	Food Truck Trend	Gratitude	Food Truck Friday	Locations	Truck Mentions	Menu Items
<b>Top features</b>	thanks @wingzzatruck great cupcakes today just see @thetinkitchen tonight us	lunch come see today us st trade 30 tomorrow schedule	food truck trucks great @thetinkitchen come @herban_legend #clt beer charlotte	thank great sold see us awesome day rock guys support	truck food friday rally @southendclt camden park southend tonight see	pecan 1111 ave plaza midwood dinner fork roaming tonight 8-May	@thetinkitchen @herban_legend @napolitanosmkt @sticksandcones @autoburger @southerncake #foodtruckfriday @cltfoodtrucks @papiquesotruck @turkeyand	sweet potato hash special w/ today tacos taco bacon chorizo
<b>Tweets</b>	<b>5201</b>	<b>999</b>	<b>413</b>	<b>300</b>	<b>266</b>	<b>189</b>	<b>111</b>	<b>26</b>

Figure 1. Eight meaningful clusters derived from k-means clustering analysis.

After eliminating the “Miscellaneous” cluster, the remaining seven clusters were used as a framework for further analysis such as to tally the tweets and retweets for each vendor (Figure 2). This analysis shows the manner in which various types of information were retweeted (i.e. reposted or forwarded) on Twitter. The chart shows the “Schedule” cluster was tweeted and retweeted most frequently across all the clusters suggesting that the element of time is highly important information in the operation of a mobile business. Also the clusters “Food Truck Trend” and “Food Truck Friday”, that include general terms about food vending and terms related to a popular event, were consistently retweeted across all categories revealing that tweets with common catch words and dialogue about food trucks disseminates across Twitter accounts frequently. Interestingly, tweets that include terms about “Gratitude” generated very high retweeting activity for the @WingzzaTruck and @roamingfork showing communication can extend past the point of sale generating positive relationships between vendors and customers. Similarly, the owner of @roamingfork mentioned, “Rather than focusing on money, I think first about quality and customer service. My customers need to know they are appreciated and I am thankful for the opportunity to get out there and give them what they expect. That is just how I approach life and the food trucks.” The cluster “Truck Mentions” shows more retweets than tweets which suggests a strong dialogue exists among vendors and their customers. For instance, a vendor retweeting a customer post may look like, “First @WingzzaTruck stop of the academic year! They are always so nice and the food is delish!”



Figure 2. Total tweets and retweets organized by vendor and cluster topic.

### Event Construction through Tweets

Using the lens of events as a temporal and physical activity in the practice of food vending, our goal in this analysis is to understand how events are constructed using time and location based information. Using the 6,000 tweets, we began by organizing them into two categories: event related and nonevent related. A further analysis of the each event-related tweet identified whether one or multiple events were referenced in a single tweet. Also the number of Twitter followers for each vendor was documented on February 7<sup>th</sup>, 2013.

This record of tweets was analyzed in several ways. First, the frequency and time of event related tweeting was mapped across all vendors. Second, event related tweets versus nonevent related tweets were mapped in relation to the time of the event across all vendors. Third, for each vendor the average number of one-time event locations versus commonly repeated event locations was determined and analyzed with respect time. Last, one vendor was closely investigated to determine how their event related tweets were distributed across time specific to each event.

To begin, each vendor's event related tweets were aggregated to determine the average number of tweets about an event a given number of days before the event occurred (Figure 3). Findings show: the total number of tweets for any one event ranged from 1 to 6, and the time frame ranged from three weeks before the event up to and including during the event, and event related tweets most frequently occur on the day of an event or within one week prior to an event. However, there is notable variation among

vendors on the length of time between tweets about an event and the event itself. Vendors with a higher number of Twitter followers often tweet about events earlier than those with smaller followings. @WingzzaTruck has both the highest follower count and by far the highest average number of days between a tweet and the event it references (1.94 days), followed by @papiquesotruck (1.03 days), @roamingforkNC (1.01 days), @onthegocupcakes (0.93 days), @herban\_legend (0.77 days), and finally @TheTINKitchen (0.39 days). While vendors rarely tweet about an event more than a week before it takes place, @WingzzaTruck and @roamingForkNC, the two trucks with the highest follower counts, do so most often (Figure 3). This suggests vendors with a higher number of followers value on online communication to build event awareness among their customers and do so independently of the event date.

Last, the analysis shows more established vendors such as @WingzzaTruck and @roamingforkNC, who both started their business in 2010 and have a monthly schedule in place, announce their events well in advance, whereas a younger business such as @papiquesotruck, who opening in later 2012, may determine his locations in a shorter timeframe and announces his location closer to the event date.

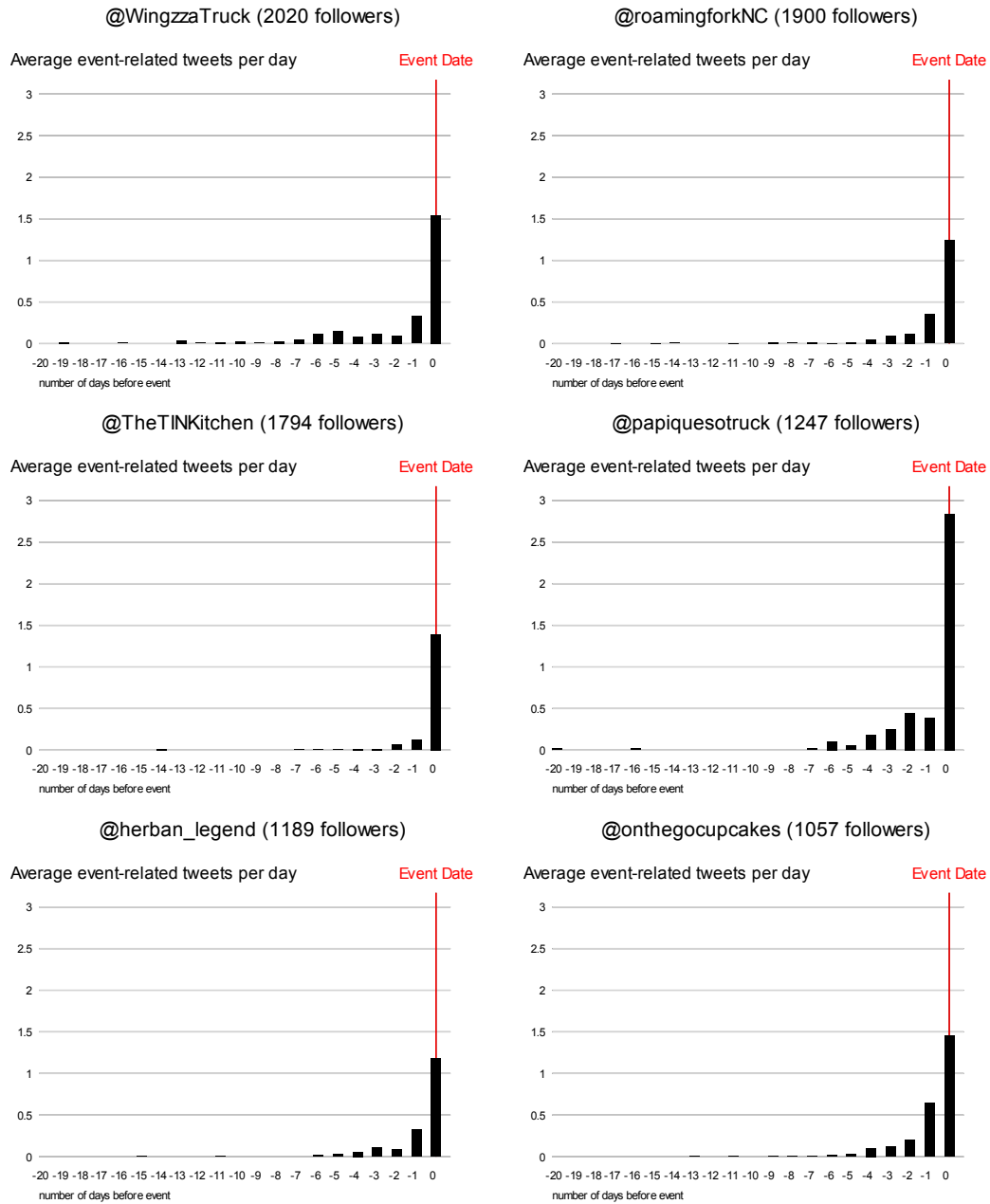


Figure 3. Average number of event-related tweets on any given day leading up to an event and vendor Twitter account follower totals.

To determine the tweeting frequency for each vendor a two month timeline was constructed showing the days on which events occur (red lines for single event, dark red line for multiple events on a single day), the numbers of event related tweets (green area), and the number of nonevent related tweets (blue area) (Figure 4). The total counts of events, event related tweets, and nonevent related tweets are listed to the right of each vendor timeline.

First, multiple events on a single day, colored in dark red, occur more frequently in the middle of the week and less on weekends which reveals food vending events are not just a weekend destination or leisurely activity, but rather a frequent food choice

during a regular work week. For example, owner of @herban\_legend, @TheTINKitchen, and @roamingforkNC serve lunch crowds three days a week at remote business park locations or college campuses.

Second, the chart reveals communication via Twitter is not solely dependent on notifying customers of event related information such as time and location. The blue areas reveal vendors often communicate about a variety of aspects unrelated to events, such as types of food, customer feedback, truck operating issues, and their personal life. A tweet by @roamingforNC states, “In Costa Rica...Rejuvenating...Relaxing...What’s happening where you are?” The vendor @WingzzaTruck tweeted, “Hey #TeamWingzza if you could add one item to our menu what would it be? Working on some things for you! #CLTFood.” The nonevent related tweeting also shows to be a consistent type of communication throughout the entire two-month mapping for each vendor suggesting it is essential to continue dialogue with followers in between events.

Third, some vendors when compared show an inverse relationship between the number of event related tweets and the number of events. For example, for vendor @herban\_legend who has 68 events and 95 event related tweets and vendor @papiquesotruck who has 42 events and 163 event related tweets the amount of event related tweets bares no relationship to an increase of events. Interestingly, this is may be related to @papiquesotruck’s lower follower count and the desire to use of social media to build a larger follower base. The vendor @papiquesotruck mentioned, “Communicating with my customers through Twitter is imperative to my business.”  
(plug, need to look at interviews)

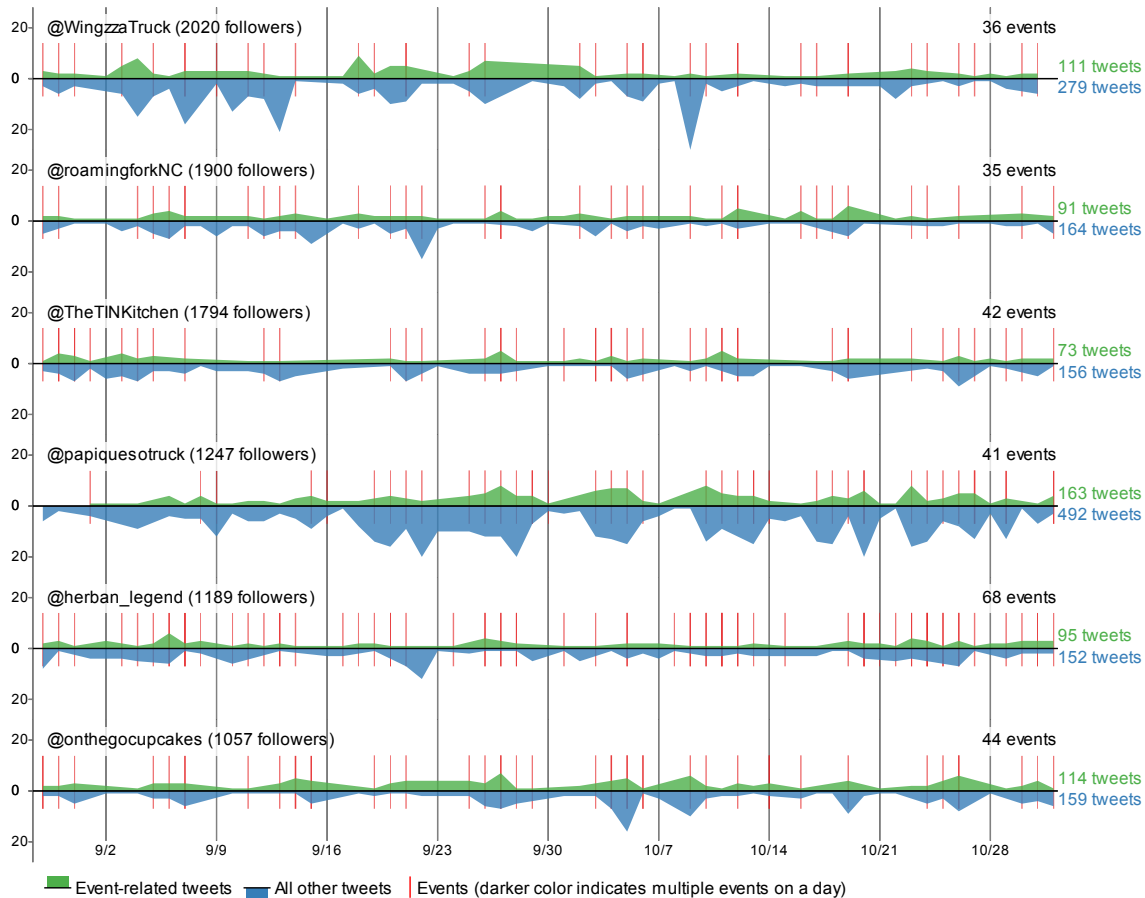


Figure 4. This graphic shows a two-month timeline of each vendor’s tweets with respect to an event using the following information: the day an event occurs (red lines), the frequency of multiple events occurring on a single day (dark red lines), the day an event related tweet occurs (green areas), and regular tweets with no mention of an event (blue areas).

For each vendor we examined the locations tagged for each event. Most locations were named multiple times for a given truck: for example, the repeated “Food Truck Friday” event. Other event locations were only mentioned one time in a vendor’s data, such as locations associated with the Democratic National Conference in September 2012. We tagged each event as either “repeated” or “unique” based on whether its location name appeared more than once in a vendor’s list of events. We tallied the number of each type of event for all of the vendors, then performed the same analysis as shown in Figure 3 to determine how many days in advance vendors tweeted about each type of event (Figure 5). This analysis shows that one-time events are tweeted about more often and earlier than common events although they take place less often than common events. One-time events are tweeted about an average of 2.61 times, versus an average of 2.19 tweets for a common event. Furthermore, tweets about a one-time event occur an average of 1.84 days in advance of the event, whereas the average for a common event is 0.86 days.

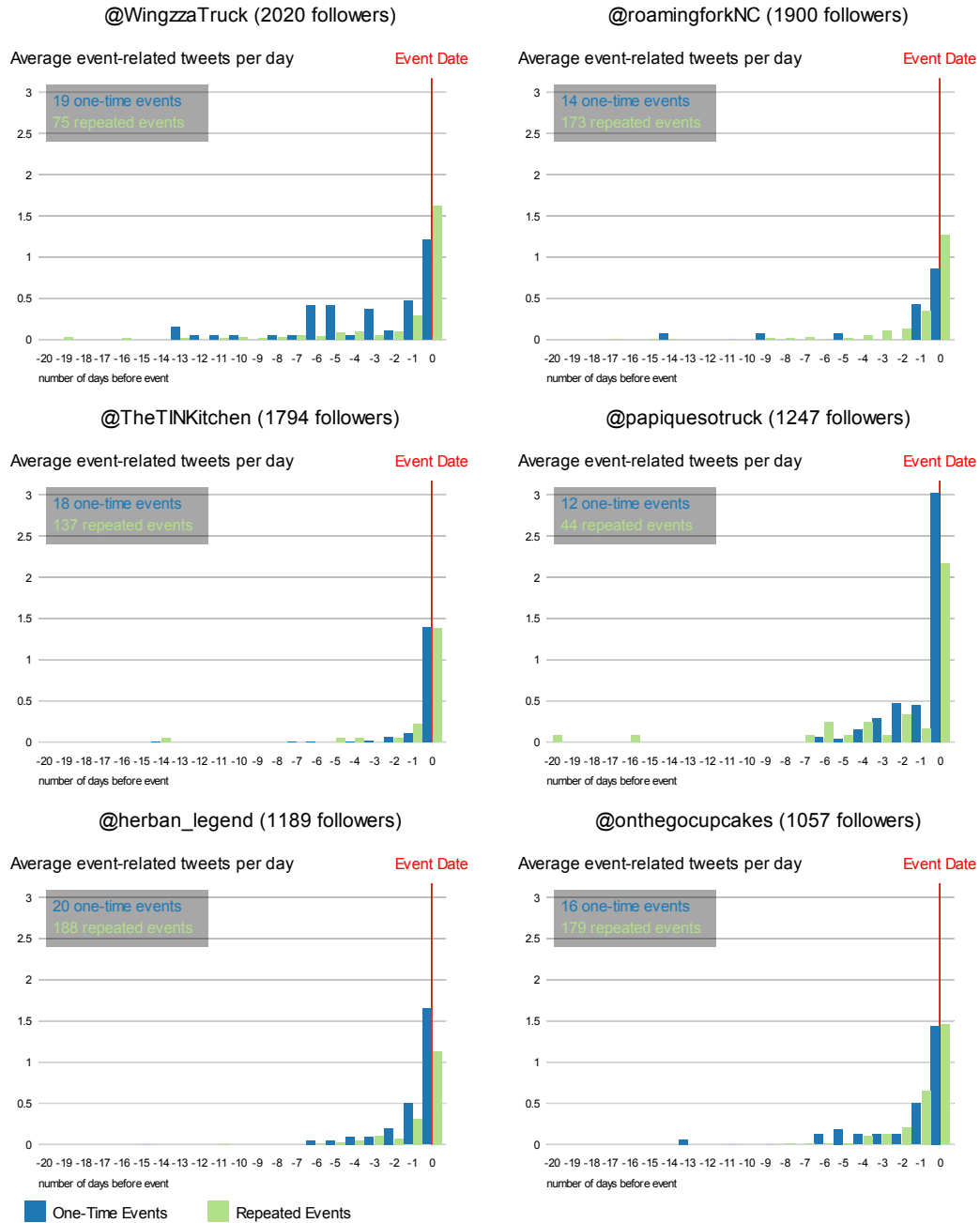


Figure 5. Average number of one-time event locations and commonly repeated event locations per vendor.

Next, we investigated a single vendor to better understand event related tweets in relation to a vendor's events (Table 2). Using the vendor @herban\_legend the total number of event related tweets was 209 out of 1000. Of these 209 tweets, 125 occurred on the same day as the event showing 40 percent of tweeting about a location occurs prior to the day of the event.

Table 2: Summary of spark line graphic showing the relationship between the number of events and the number of event related tweets.

<b>Number of Events</b>	<b>Number of Tweets</b>
<b>1</b>	<b>9</b>
<b>2</b>	<b>6</b>
<b>7</b>	<b>5</b>
<b>12</b>	<b>3</b>
<b>13</b>	<b>4</b>
<b>58</b>	<b>2</b>
<b>116</b>	<b>1</b>

For each one-time event, every tweet that mentions that event was identified. We then generated a spark line for each event that shows the pattern of tweeting identified with each event (Figure 6). A pattern can be noted of many events that are tweeting well in advance of the day of the event, and often multiple times. This shows that a vendor tweeting about an event can occur well before the time of the event and may have little relationship to the event day. This asynchronous relationship between the event and communication is represented in the following: 33% of all events (or 69 of 209) have a single tweet at least one day before the event, 61% of events with two or more total tweets (or 58 of 95) have at least one tweet before the day of the event, and 92% of events with three or more total tweets (or 33 of 36) have at least one tweet before the day of the event.



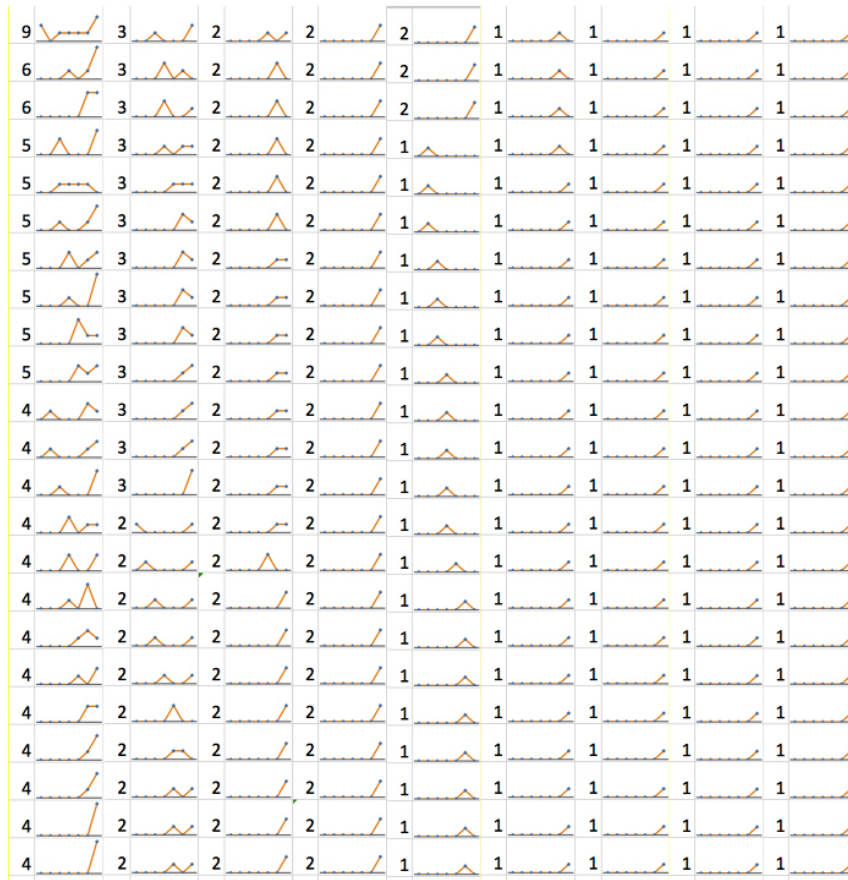


Figure 6. For the vendor @herban\_legend tweets related to an event are mapped across time to construct a timeline specific to each event. The largest amount of tweets related to a specific event is nine and the least amount is one.

### *Vendor Time-Space Sequencing*

The next analysis spatially maps the vendors' choice of location over time (Figure 7). This was analyzed for two time frames: over the course of an entire year to illustrate the relative popularity of locations and over the course of one week to illustrate the movement between locations. Vendor location information was collected using individual vendor websites and by logging vendor tweets on Twitter over 12 months.

First, a map was constructed to graphically illustrate the locations and frequency of each truck. Locations that were visited three or more times by vendors within the 12 month period were geographically marked using a circle. The diameter of the circle (measured in pixels), corresponds to the number of times that location repeated among all vendors. For example, if a location was visited eight times, the diameter of the circle would be eight pixels. A color was assigned to each of the six vendors. If more than one vendor visited a location, the circle was divided into a pie chart that would correspond to the percentage of times that each vendor frequented that particular location.

The second map frame relates to the spatial movements of the vendors. The tweet and vendor website data showed that the activity of the vendors often reoccurs in a weekly pattern. A random week was chosen and a line composed of arrows connects the locations or dots in the order that they were visited. This process was repeated on a

separate map for each vendor and then layered to create a single map that depicted how all of the vendors moved throughout the city over a weeks time.

This spatial and temporal analysis of food vending activity in Charlotte provides a way to visualize the frequency of the use of space as well as the flows of movement between locations. The map addresses a recent urban phenomenon where vendor mobility combined with the use of social media has leveraged underutilized physical spaces of the city to serve their needs. The mapping of vendor locations also reflects many of Charlotte's geographic and cultural characteristics: a compact downtown urban core, a decentralized landscape linked by an extensive roadway system, office and business parks located on the southern periphery of the city, the university as a node of activity north of the city, and major thoroughfares and areas of commerce serve as destination points for vendors embedded throughout the city.

The analysis also shows a large amount of vendors utilizing or sharing the same areas in the downtown urban core, an area typically banned from vending activity. Data shows these locations are the sites of monthly or annual large-scale events hosted by the city such as the Democratic National Convention and Chow Down Uptown. Unlike the annual permits required by vendors outside of the downtown, these events required a special one-time event permit for a limited amount of time.

The movement of vendors shown through the use of arrows connecting the vending locations realizes the vast distances vendors are willing to drive to on a regular basis. Much like the telephone permitted the decentralization of communication and city structure in at the turn of the century (Fisher, 1992), social media communication in this setting is providing the expansion the food vending economy. Small businesses on wheels are assured business through the means of digital communication.

Mapping the dynamic flows in cities has continually been a challenging task for cartographers, but is highly useful in understanding the future urban use patterns. In this map we hope to represent and visualize the interplay between physical space, time, and movement as layers of contemporary food vending practices.

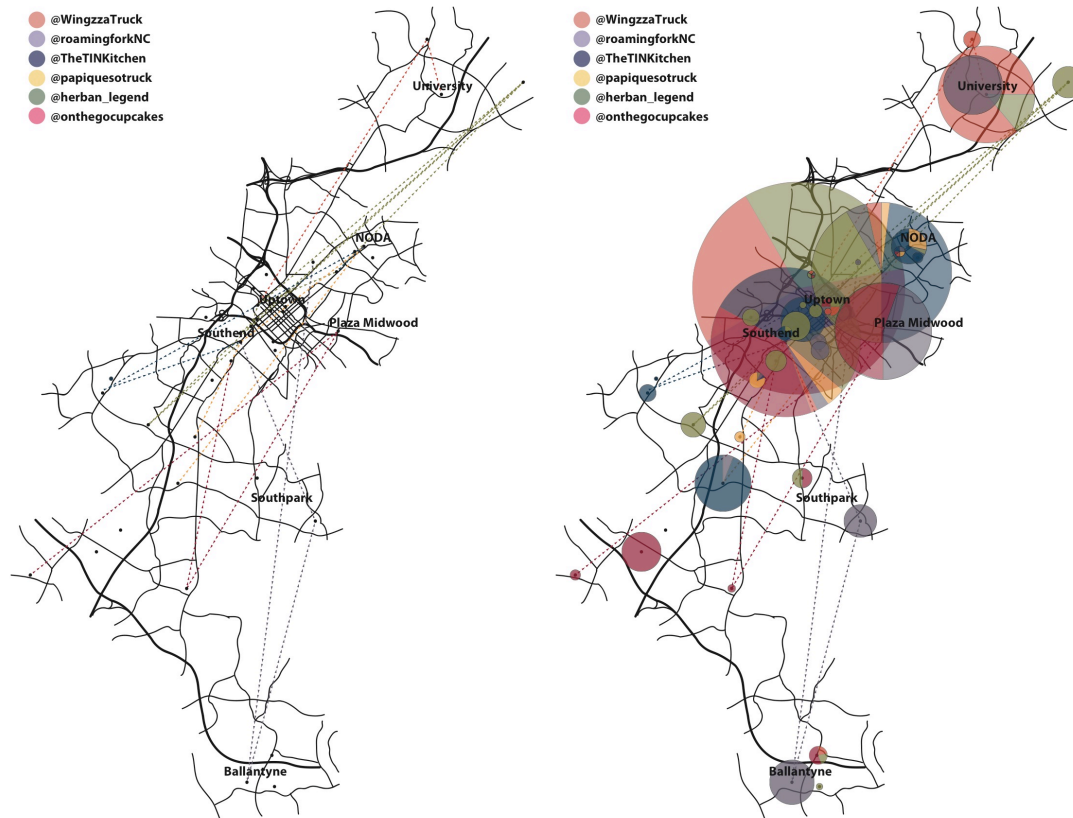


Figure 7. Vendor movement and location frequency of travel.

### Event Space

Based on the highest frequency of events, five event spaces were identified for further analysis to better understand the qualities of place. These locations include a variety of place types such as a vacant downtown lot, auto body shop parking lot, a university thoroughfare, business park parking lot, and a brewery parking lot. Using standard urban design analytic techniques, we studied both the immediate site of the trucks and their position with a larger neighborhood. Our goal was to study the creation of these spaces and their relationship to traditional gathering places in cities such as parks and plazas which are characteristically centrally located with respect to a neighborhood or city, accessible by foot from other amenities such as civic buildings, public transit, museums, or retail establishments, contain significant amounts of open space for activities or to recreate a pastoral setting, include features of design such as seating, vegetation, fountains, infrastructure for activities, and shading devices or trees.

The first event space is a privately owned vacant dirt lot that is situated in on the periphery of the central business district of Charlotte, also known as Historic South End. Five to ten food trucks park here on Friday evenings seasonally. With the help of Charlotte's downtown association, also known as City Center Partners, the site became home to food trucks on October 27, 2011 and has continued to expand since. A City Center Partners representative stated a number of factors that were used in determining this location for the event: visibility from pedestrian paths, scale of the space so that it could accommodate the food trucks while also intimate enough for patrons, close proximity to an establishment that has restrooms, available parking for the event, and few

nearby food establishments. Surprisingly, this site it most closely resembles a traditional urban gathering space in regard to the other study locations with its abundance of open space and accessibility to retail and public transit. Yet, even though the site is highly active during the event, is left unused otherwise, lacks permanent infrastructure for activities or seating, has relatively low pedestrian movement on days other than Friday, and lacks shade devices or trees. The location is unique in that it serves no purpose unless this event is taking place, yet, it conforms to some traditional norms of gathering spaces when it is active.

The second location caters to lunchtime patrons multiple days of the week on an active vehicular thoroughfare adjacent to a culinary university and a residential condominium known as Gateway Village. Key factors in the success of this location are the variety of nearby seating such as table and chairs, low walls and grassy embankments, and covered plazas, as well as the proximity to students interested in culinary careers, and truck visibility to vehicular traffic. We categorize this location as having a good amount of traditional gathering space guidelines given its accessibility by foot to residential and educational buildings as well as nearby infrastructure for seating and shade. However, the space does not serve as a designated gathering space, rather the presence of the food trucks parked on a busy street activates nearby spaces.

The third space, which has little resemblance of a traditional gathering space, is an auto body shop parking lot adjacent to a historically affluent neighborhood east of downtown Charlotte known as Plaza Midwood. Three vendors use this space every Thursday and Friday evening through an agreement with the lot owner. The trucks locate on the lot with a sensibility to vehicular traffic on Pecan Ave. Although their location is in walking distance to other retail establishments in Plaza Midwood, a majority of customers were observed arriving by vehicle. Customers that arrived in small groups typically pulled out lawn chairs or sat on the grass while others opened the back hatch of their vehicles. Employees of the auto body shop were also observed purchasing food from the vendors near the end of the workday suggesting the location serves nearby businesses. Much like the Gateway Village location, the vendors chose a location that responds to the flows of the automobile. In comparison to traditional gathering spaces, the location bears little resemblance other than the adjacent grassy open space.

The next event space in the NoDo Historic Arts District north east of downtown is nestled behind a local popular brewery. The paved parking lot accommodates a single truck in the evening most days of the week and is organized by the brewery owner. Given the remote location of the brewery, the majority of customers who visit this location tend to drive; however, because of the truck's close proximity to the taproom, customers tend to occupy the site for a longer period of time than in other locations. The site does offer seating for patrons indoors the brewery and outside, but lacks open space, shade, visibility to pedestrian or vehicular traffic, or other amenities.

The last location is a parking lot located in the Baxter Office Park south of the central business district. This site is defined by an abundance of surface parking. Patrons working in nearby offices were observed taking their food to their cars to eat alone, sometimes in pairs, others were seen taking their food back inside the office building. Given the short lunch hour and the lack of seating options, patrons socialized less at this location. This office park location has large influxes of people and then lulls of emptiness. A food vendor also mentioned that some of her more dedicated customers

would order in advance, allowing them to avoid lines and simply pick up their prepared food. Others eat the same thing each week, and the vendor will have the food prepared for them, knowing they are reliable customers. The design elements of this space has no bearing on the experience of the vending.

Each of these spaces falls outside of the traditional notions of gathering spaces in cities with some variation. Most notable are that these spaces were never initially conceived with regard to accommodating people formally or informally. They are locations situated in predominately privately owned and underutilized spaces of the city that offer an opportunity for vendors. Unless a location has an assured customer base through a partnering establishment, the spaces share an awareness making their truck visible to foot or vehicular flows. Unbeknownst to vendors these spaces have evolved into rich places full of urban life and activity and are in many ways surpassing traditional gathering spaces producing economic, cultural and social exchange and diversity.

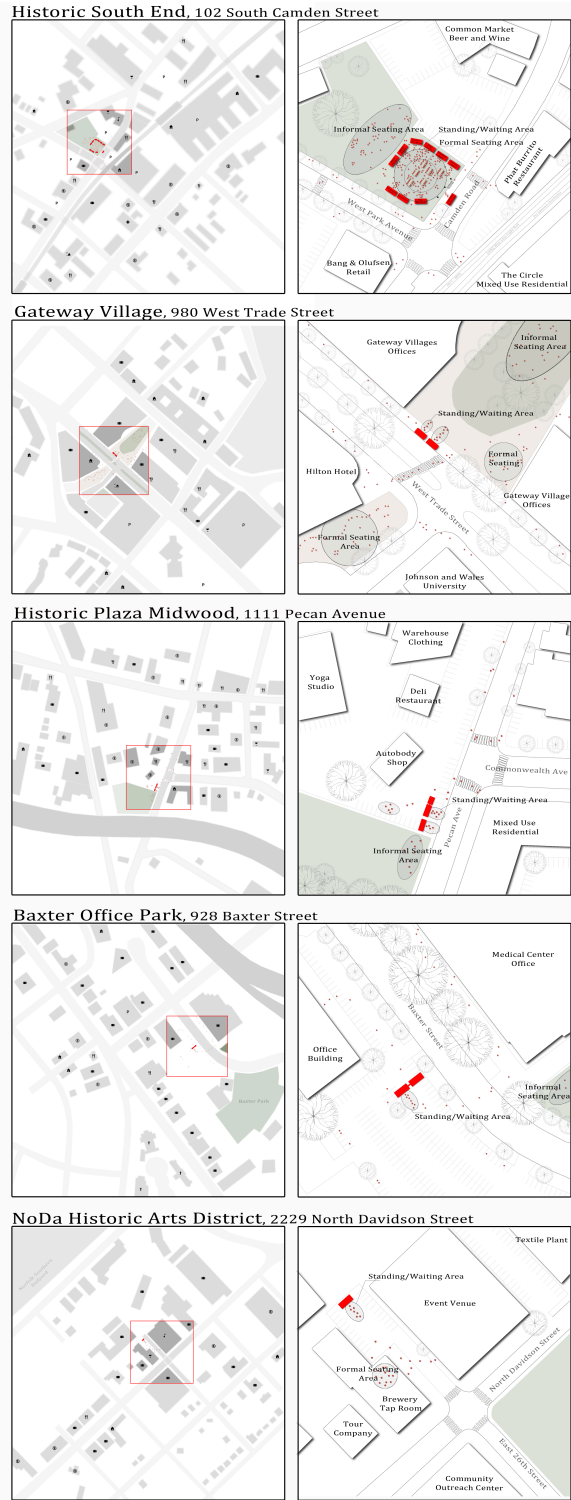


Figure 7. Five event locations arranged based on their characteristics of traditional gathering spaces (i.e. parks and plazas) in cities.

## VI. Conclusion

As we began this research, we faced the question of how the spread of information and mobile technologies would affect the use, and even the relevance, of the city. Would the combination of Twitter and mobile food vending change the way in which cities are understood and used?

Two extreme positions immediately suggested themselves. On the one hand, the mobile food vendor might find places in the city that closely followed and reinforced the existing spatial pattern of urban development. If this were true, existing methods from the field of urban design would be sufficient to understand and plan for the growth of contemporary mobile food vendors. The gaps in the urban fabric can be identified and filled by mobile vendors.

On the other hand, it is possible that the combination of social media and food vendors could lead to extreme diffusion. The locational decisions of a truck could be influenced by the aggregate need determined by social media; the truck could move to meet the greatest number of customers. Given good enough data, the vendor's truck could move many times over the course of a single day; a "just-in-time" restaurant. In this scenario, urban design as we know it is irrelevant; the trucks would move frequently and without regard to the nature of the space they occupy.

Our field research immediately led us to suspect that neither of these explanations was a very good fit; data and space seemed to be weaving together in a way that was interdependent. Our descriptions of the space using canonical methods of urban design could not explain the locations of the trucks with any degree of certainty. The description of the data in the network using either topic modeling or temporal information was only meaningful with some knowledge of the spatial locations. The use of events as unique combinations of spatial and time provided a theoretical framework to understand the content, the timing and the distribution of tweets.

As mentioned in the introduction, the idea of recombination of the human and the technological, familiar to us from actor network theory (Latour, 2005), seems to be equally true for the recombination of space and events. Further, theoretical work on events by Zacks and Tversky (2001) identifies a commonality of analysis by philosophers and psychologists, treating objects and events using the same categories and methods.

Within the field of urban design, the emphasis on the spatial over the temporal has become a serious drawback, making the understanding of new forms of urbanism difficult to see or to analyze. Considering only the informational network would be equally one sided; our analysis of these urban events in Charlotte represent some first tentative first steps toward an integration of spatial and network methods. Without some such method, the field will continue to struggle to understand and design for contemporary urbanism.

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<sup>i</sup> The average food truck business generally requires \$55,000 to \$75,000, whereas a brick and mortar restaurant can cost in the range of \$250,000 to \$500,00.