



Tell Me Where You Are and I'll Tell You What You Want: Using Location Data to Improve Marketing Decisions

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KEYWORDS

*Location Data, Location Intelligence,
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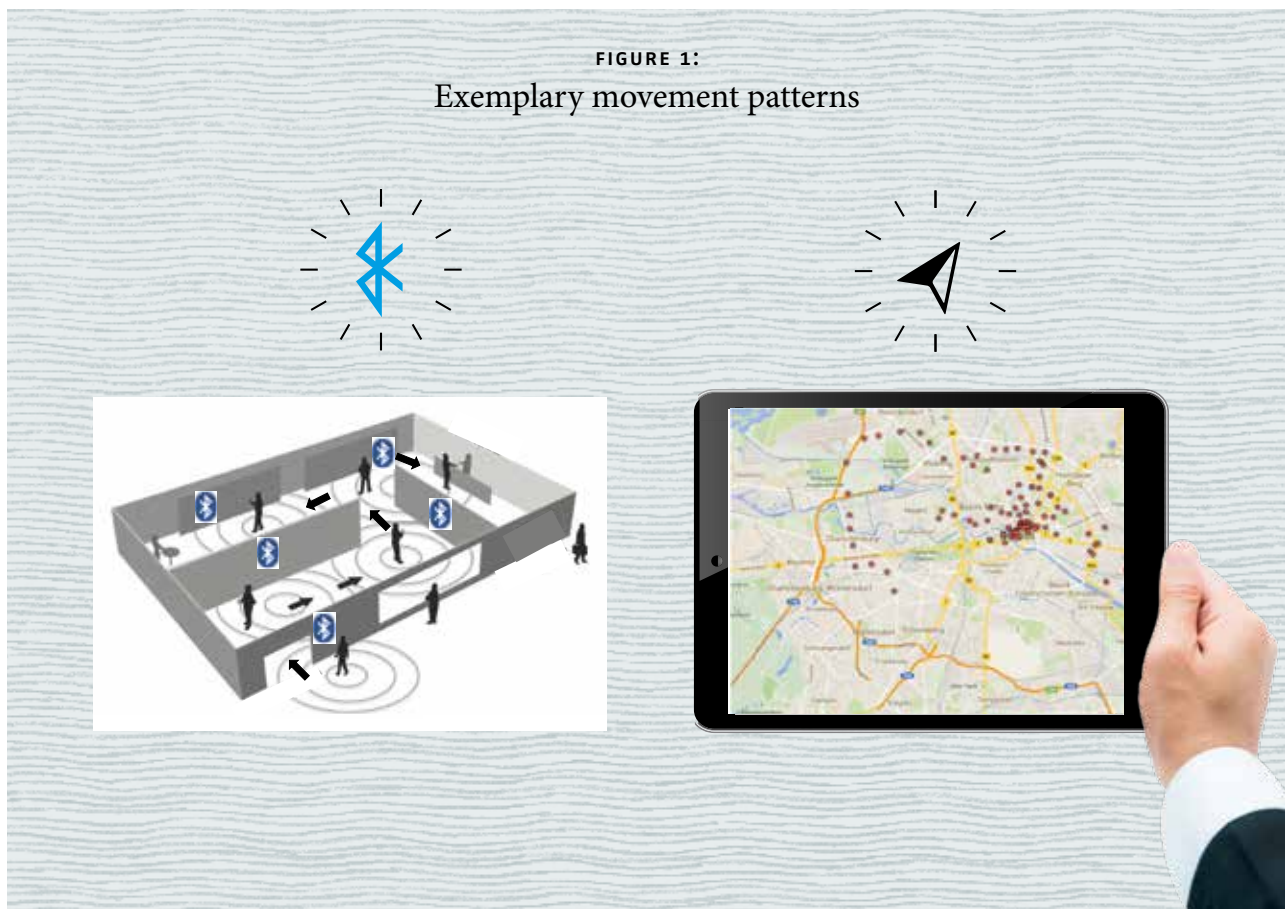
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Context matters /// Consumers choose what they like, but their preferences depend on their specific situation. Situational variables like time, day of the week, season, local weather or social situation and, of course, specific locations form the context for all decisions. A person might feel and act differently on a workday than on the weekend, in summer or winter, on a sunny or rainy day, whether alone or with family and friends, out in the countryside or in a shopping mall. The digitalization of business processes has been tremendously helpful in identifying those preferences and leaving a broad and rich data trail. This development has even intensified by the increased popularity of smartphones. Smartphone applications generate situational variables, including path data such as movement sequences through supermarket aisles or the movement patterns within different parts of a city. Figure 1 visualizes movement patterns based on the physical location of smartphones or other devices.

Location data – the new cookie? /// Location data become more and more accessible. Location-based advertising is one application that takes advantage of those context factors. Mobile ads might be tailored and targeted for consumers who happen to be in a certain area or even in or within a small radius of a seller's store at a certain time. The total value of real-time location-based advertising is supposed to grow to about \$15 billion in 2018 or approximately 40 percent of total mobile advertising, according to a research report from the Swedish Berg Insight market research company. Not surprisingly, location is sometimes referred to as the new cookie.

FIGURE 1:
Exemplary movement patterns



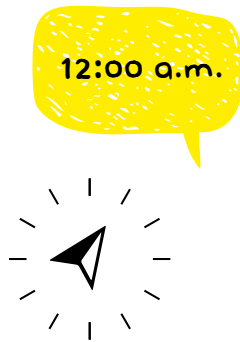
While desktop cookies allow identifying a browser's activities over time, a consumer's physical location is an indicator of his or her preferences in the "real" world. Therefore location is more relevant for offline shopping patterns. It is hence tremendously important for companies to understand how this type of data can be leveraged to improve marketing decisions regarding promotions, pricing, the assortment of products and the choice of store locations.

How to obtain location data /// Smartphone applications such as location-based services already collect location data on a large scale. To do so, smartphones use a combination of sensors and determine the current location of the device. The most prevalent method is based on the Global Positioning System (GPS). As GPS has some limitations in areas with tall buildings and as it does not work well indoors, other methods are available for these settings. A database of known locations of cell towers and WiFi networks makes it possible to determine the smartphones' locations using lateration and triangulation. For indoor settings there is Bluetooth

Low Energy (BLE). This system is based on short-range radio signals. Active components or senders are placed in specific places. When a smartphone comes into reach of one or more senders the position can be determined. An example for this technology is Apple's proprietary iBeacon protocol.

How to analyze location data /// Analyses of location data can be conducted either in retrospect or in real time. Dependent on the type of observation, we further distinguish between cross-sectional designs with one data point per consumer or longitudinal designs with several measurements over time. Table 1 gives an overview of the different types of analyses and what they show.

Retrospective analyses of cross-sectional or pooled location data can be used to generate snapshots of location-specific preferences based on clustering analyses. In addition, retrospective analyses of longitudinal location data can be conducted by applying vector autoregressive models. Such applications have already been used in the context of online browsing and path analyses between different websites.



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Mobile ads might be tailored for consumers who happen to be within a small radius of a seller's store at a certain time.

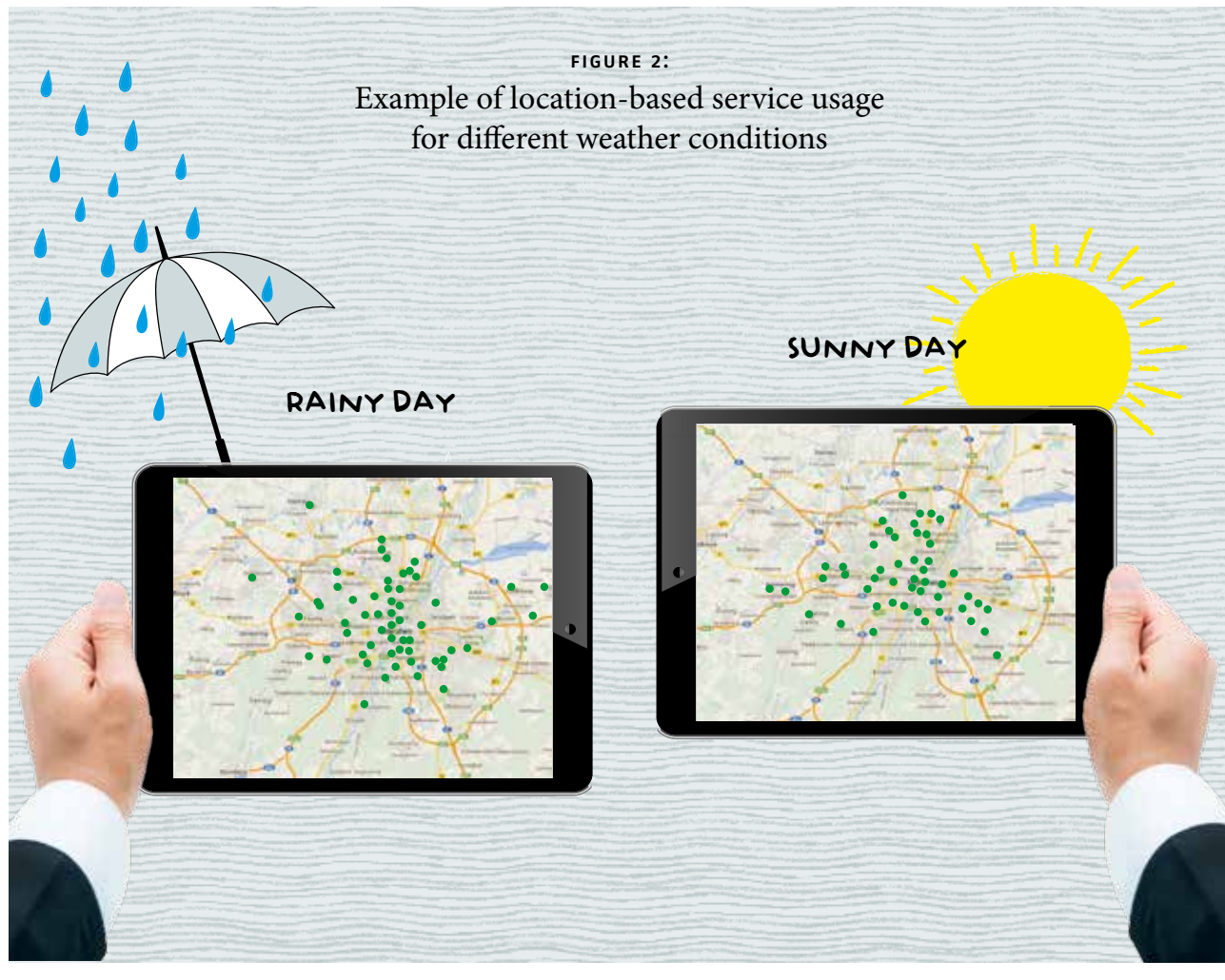
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TABLE 1:

Summary of analyses and observation types and their application

		OBSERVATION	
		CROSS-SECTIONAL	LONGITUDINAL
TYPE OF ANALYSIS	RETROSPECT	OBJECTIVE: SPATIAL PATTERN IDENTIFICATION ANALYSIS TYPE: CLUSTER ANALYSIS APPLICATION: CUSTOMER SEGMENTATION	OBJECTIVE: SPATIAL TIME SERIES ANALYSIS ANALYSIS TYPE: SPATIAL/VECTOR AUTOREGRESSIVE MODELS APPLICATION: TRAJECTORY-BASED SEGMENTATION OF CUSTOMERS
	REAL-TIME	OBJECTIVE: SIMILARITY/PERSONALIZATION ANALYSIS TYPE: COLLABORATIVE FILTERING (VIA MACHINE LEARNING) APPLICATION: DISTANCE-BASED REAL TIME DISCOUNTS (LOCATION-BASED COUPONS)	OBJECTIVE: LOCATION PREDICTION/TRAJECTORY ANALYSIS TYPE: CLUSTERING AND COLLABORATIVE FILTERING (VIA MACHINE LEARNING) APPLICATION: TRAJECTORY-BASED REAL TIME DISCOUNTS (LOCATION-BASED COUPONS)



They allow marketers to segment customers based on their geo-location or their movement paths or trajectories. On the contrary, real-time analyses are automated approaches in the backend of smartphone applications. An example of real-time analyses of cross-sectional location data is model-based collaborative filtering algorithms. These applications suggest coupons to consumers based on the activities of other customers in the same location, and well-established machine learning techniques already exist in the context of recommendation systems. In addition, machine learning techniques can also be applied to predict preferences based on the location and trajectory of consumers in real time as well as to dynamically adapt the discount depth on personalized coupons. For example, deeper discounts might be necessary for more distant customers than for customers that are closer and already moving towards the store.

Location data might be able to provide even more interesting insights when combined with other data sources such as demographic or transaction information, the weather, social network/co-location, or survey data. For example, the combination of location, co-location and transaction data can be used to predict coupon choice and personalize offers based on the weighted information of previous purchases and similar individuals. In addition, survey data like psychographics can also enhance location information by delivering insights into the intentions and motivations of certain location-based activities, which can again be used to improve the prediction of locations or trajectories. Figure 2 shows how a combination of weather and location information can deliver insights into the use of a location-based service: higher intensity in malls and shopping areas on a rainy compared to a sunny day.

TABLE 2:
Overview of marketing decisions that
might be improved using location data

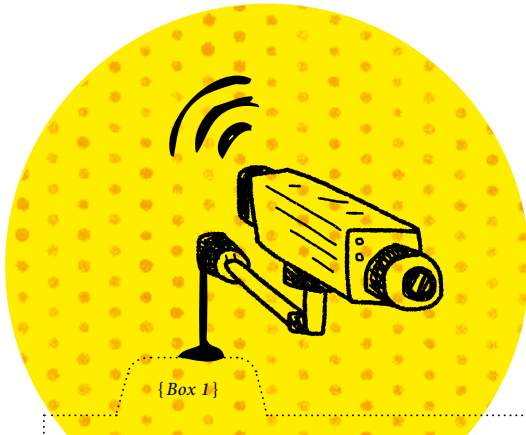
MARKETING DECISION	DATA SOURCE	ANALYSES (EXAMPLES)	PURPOSE
ADVERTISING	PURCHASE HISTORY OWN APP MOBILE AD PROVIDERS	LOCATION PROXIMITY MOVEMENT/TRAJECTORY TEMPORAL PROXIMITY	LOCATION TARGETING REAL-TIME TARGETING
PRICING	COMPETITORS' STORE LOCATIONS CONSUMERS' TRAVEL HISTORY	LOCATION PROXIMITY MOVEMENT PATHS	DYNAMIC PRICING PRICE DISCRIMINATION
STORE ASSORTMENT/ LAYOUT	CONSUMERS' IN-STORE MOVEMENTS (RFID, BLE BEACONS) OWN APP	IN-STORE PATH ANALYSES SHOPPING-BASKET ANALYSES	POSITIONING OF PRODUCT CATEGORIES AND BRANDS IN-STORE ADVERTISING
STORE LOCATION	CONSUMERS' OUTDOOR MOVEMENTS OWN APP MOBILE AD PROVIDERS	LOCATION PROXIMITY MOVEMENT PATHS	STORE LOCATION CHOICE COMPETITIVE ADVERTISING

Improving Marketing Decisions with Location Data

> **Location-based advertising** /// Location-based advertising is a natural choice for marketers. It can be utilized either by developing/using an own application or by joining existing mobile ad providers. Location-specific ads change online and offline advertising by providing more effective methods, such as location targeting. Location-based push advertising seems to be particularly suitable for matching retailers and consumers in real time. It is similar to display advertising and allows targeting consumers dependent on their behavior and/or the situational context. Both, spatial and temporal proximity can significantly increase the effectiveness of SMS-based targeting strategies.

> **Location-based pricing** /// Besides advertising, location data can also be used for dynamic pricing decisions. For example, companies may conduct location-based price discrimination between own and competitor's customers. More precisely, customers close to competitor's locations can be charged a lower price for particular products via discounts in order to reduce switching costs. The combination of the consumers' whereabouts based on location data and competitors' store locations makes these pricing decisions possible.

> **Optimization of store layout** /// Location data from indoor tracking technologies such as Bluetooth Low Energy traces or WiFi networks are able to provide valu-



... AND WHAT ABOUT PRIVACY?

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While all forms of targeting raise privacy concerns, tracking tools that record an individual's whereabouts are particularly sensitive. Consumers, especially in Europe and in the United States, are increasingly uncomfortable about the privacy implications of location data.

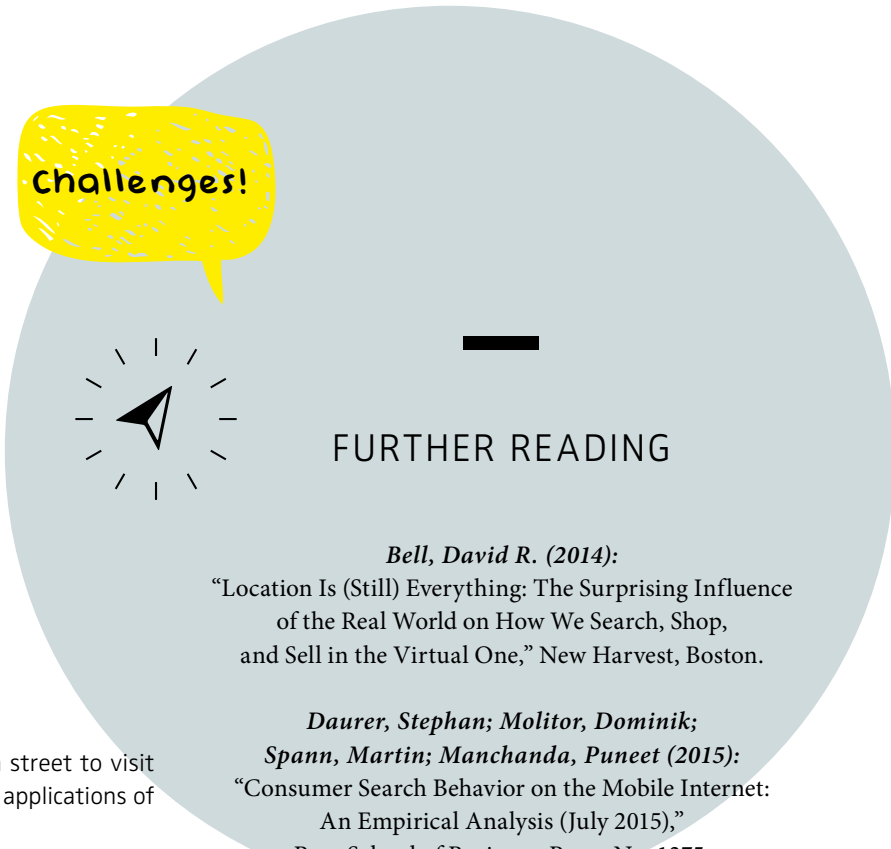
One critical aspect of the use of location data is its potential to reveal consumer identities – based on path data – even if the raw data is anonymous. This trade-off between more detailed user data leading to highly targeted ads and privacy concerns is currently approached differently. Google, for example, strongly pushes into data-driven personalization algorithms, such as mapping and directions, via Google Now on Android. Apple, on the contrary, is approaching similar personalization features via Siri, with the difference that most automated tasks will be conducted directly on the phone, without being uploaded into the cloud. Previous research has also suggested new privacy-friendly targeting mechanisms without compromising the benefits of location data.



PRIVACY?

able insights about consumers' in-store movements. Previous research has already analyzed consumers' movements using path data from radio-frequency based RFID shopping carts and identified different clusters of in-store travel activities. The same can be done with mobile devices. Smartphones will also be able to cover the paths of consumers that haven't picked a shopping cart, provided that they have downloaded a retailer's or an ad provider's mobile app. Information on customers in-store movements and product choices allows retailers to optimize their store layout as well as the positioning of product categories and brands within the store.

- > **Choice of store locations** /// Furthermore, information about consumers' outdoor movements, for example between home and work locations, gives valuable insights into their location-specific preferences. This type of data might help retailers to decide where to open new stores. Granular location data about consumers' movements allows for minimizing potential offline transaction costs based on distances to stores, which are known to be important drivers of store choice. This information may, for example, enable a retailer to pick a side street location for a store, thereby saving rent, with location-based advertising



Challenges!



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inducing pedestrians from a nearby main street to visit the store. Table 2 summarizes some major applications of mobile data analysis.

Outlook – the future of location data /// Location data offers great potential to improve a variety of marketing decisions such as targeted pricing and advertising, store locations and in-store layout. Companies have been experimenting with some of these new opportunities, but up to now most approaches are still static, relying on past data. New developments in machine learning and artificial intelligence will, however, soon enable more dynamic real-time use of location data and thus create competitive advantages for companies that embrace these technologies. And while we are just starting to understand how to leverage the power of location data, technological progress already generates new streams of (big) data. Sensor data related to the Internet of Things is one example. It is spanning even further, including data on personal health, smart homes, cars or industrial machines. These novel data sources will also create tremendous new challenges and opportunities for consumers, companies and researchers.