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The Uses of Proximity Social Marketing, Tracking & Analytics. Knowing Who Walks Through Your Doors & Facility

How do users interact with products in a store? What is the best disposition of artwork in a museum? Why a Science Center can know more about their visitor's interests. How can airports prevent queue formation at security checks? Predicting crowd behavior through proximity sensors is the means and the solutions for today and in the future.

Collective Behavior

Many collective behaviors are characterized, among other things, by a strong spatiotemporal nature. The behavior of the individuals is influenced by the environment in which they are embedded, which includes other individuals. Typically, objects nearby tend to influence behavior more than objects far away. In the case of a queue, we tend to enter the queue behind the person who arrived before us, and our turn to leave the queue comes when we have nobody in front of us. In the case of pedestrian lanes on a sidewalk, we tend to stay close to the people close to us walking in our same direction, and we stay away from the people passing by walking in the other direction to avoid collisions.

Besides, it is not just about low-level "*crowd dynamics*" like queues and lanes, but this is also true for higher-level forms of social behavior: we also stay face-to-face with the people we mingle with and share offices with the people we work with. And it is true also for relationships between people and objects: we face the appliances we interact with and we keep close the objects we care about and need to grab often. In other words, it is important to measure the context in which a person is immersed to understand his or her behavior. To this end, we need to identify who and what is in somebody's proximity, and how these change over time. But how do we do this?

Proximity Social Sensors

As it turns out, most of the people have in their pocket or in the palm of their hand, a powerful computer with plenty of sensors: ***a smartphone***. Nowadays, smartphones come with all sorts of sensors, and one of them is a proximity sensor, often implemented through a *Low Energy Bluetooth radio*. Which ***CommSmart Global Group, a LexisNexis Risk Solutions Partner*** took the bull by the horns some seven years ago and have created an industry with powerful analytics.

Proximity Sensors enable smartphones to detect phones (or other devices with a Low Energy Bluetooth radio, like a beacon) within a distance of few feet and up to 100 yards as a radiated signal, as a notification. We have been installing such sensors also in our appliances and in general in our cities for the last three and half years.

The way they work is very simple. Periodically, devices broadcast their unique identifier over the air to a controlled distance range (for example, up to 300 feet or much closer), and the devices that receive such broadcast can infer that they are within a distance from that device. We even can have ***in-house navigation*** for a facility as well.

Why Use Proximity Sensors?

Proximity information is rich compared with coordinates on the planet of each individual, such as those provided by GPS. Through our technology, the proximity sensor is easier to measure, as it does not depend on complex infrastructure (like satellites in orbit). Aspects of collective and crowd behavior are captured with solely proximity, but for those aspects and behaviors that do allow for it, proximity is a means to measure behavior at a larger scale because of its superior simplicity.

Luckily, queues, pedestrian lanes, community, and co-worker relationships can be analyzed through proximity information, and the possibilities are countless, which includes sending direct information to a smartphone within airports, smart parking, conferences, event centers, even a video file at a specific science exhibit, coupons in a supermarket, medical information within a healthcare facility and even a menu in a restaurant! Oh, the food delivery service once it reaches its destination, telling those around them that *Jimmy John's* just delivered.

Because of their simplicity, companies like Google, Apple, and Facebook have invested in platforms based on proximity data, for example, through so-called proximity beacons. Beacons are small and inexpensive devices provided with a proximity sensor based on Bluetooth Low Energy, that we can install at places like a shops/supermarkets/sports goods/outdoor stores, the hall of a train station, a bus stop, and even the bus. They allow our smartphones to pinpoint where they are, hence enabling location-aware computing.

Proximity information also allows the owners of the beacons, like the shop owner or the manager of the train station, to gather a picture of how individuals behave and move inside of their space. With customer proximity data, practitioners can compute all sorts of analytics that are not so different from the analyses the same companies run on the traces their users leave behind when they interact with their products and platforms online through a browser. Is product placement effective? Do customers come back? How long do they spend in each department? What is the path used most commonly to reach train platforms throughout the day? When are bus stops crowded during the day?

The Challenges Down The Proximity Road

When one decides to go down the road of proximity-based spatial information, there are a number of challenges that need to be tackled, which *CommSmart Global Group* has taken care of with our professional hand-holding and installation process.

Our gathering of proximity data is with supported data analysis. One effective way of representing proximity data is through so-called proximity graphs. These graphs represent the relationships between two entities that were within a certain distance and available in real-time!

Then, once the data is collected and represented through proximity graphs, one needs to identify the right data mining algorithm to recognize, quantify, and qualify the behavior of interest. Graphs are well studied in Computer Science literature, and there are a number of algorithms that can be used or adapted when it comes to understanding behavior in proximity graphs. This is where we excel with our logical global data background

Crowd Behavior In Museums

At the CoBrA Museum of Modern Art in Amsterdam, they deployed a number of proximity sensors to be either installed at artworks, which were able to track the smartphones and some worn by the visitors of the museum and used them to measure how long volunteering visitors spent in front of each artwork and in which order. Subsequently, the data collected informed the museum staff of the behavior of their visitors, in particular, how visitors distributed their time across paintings and rooms have been examined.

The clustered visitor data was used to identify group behavior. Enable discovery that around 10% of the visitors actually went through the exhibition from the end to start, perhaps confused by the signs. In addition, the majority of the visitors tended to walk along the perimeter of the museum, giving less attention to the more internal walls. Showing that there were groups of individuals who distributed their time in a similar way across paintings, perhaps due to similar taste, and these visitors did not come to the museum together. This was a leveraged aspect to predict how much time visitors would spend at an artwork, looking at her past behavior.

A similar study was conducted by the Van Gogh Museum, but, instead of sensors, they used human observers that tracked the movements of a number of individuals. They obtained similar data to the one we obtained at CoBrA (but because it was based on human observers, it was a one-shot study), and they used it to rearrange part of their exhibition, showing indeed the validity of the approach.

A repeated similar experiment at the NEMO Science Museum in Amsterdam. There, we tested whether our monitoring technique could operate in the conditions when it was most needed (and when existing technologies fail): in a complex and crowded building. We ran a similar experiment during the days before Christmas when the NEMO hosts some of the largest crowds.

The NEMO building is particularly challenging for sensing technologies, as it is a big multi-story open space, full of children running around. Another interesting aspect of NEMO is that it has some periodic events that attract the attention of large portions of the visitors, potentially creating flows of people across floors and high densities around the area where the event takes place.

It showed how the "*Chain Reaction*", taking place on the first floor of the NEMO Science Museum, influences flow of visitors from and to the first floor of the museum.

Special timed events where the "Chain Reaction" takes place, increase right before the event itself takes place at 11:15 AM, 12:15 PM, 2:45 PM, 3:15 PM and 4:45 PM and the number of people leaving the floor spikes right after the event finishes 15 minutes later, as they leave the location. This information gives quantitative data for provisioning enough space for the visitors at the event location.

In A Nutshell

To conclude, the ***CommSmart Global Group Proximity Social Sensors*** have opened a window into the digital world over our lives in the real world. The number of sensors and devices we are carrying, in the smartphone and installing in our homes is growing and it is just the beginning. Already the next generation of appliances and Internet of Things are able to collect, share, and analyze a large volume of data about our behavior which we can put to great use to increase our safety and comfort.

A number of challenges lay ahead, many of them involving guaranteeing privacy, but also the fusion of multiple sources of data, energy-efficiency, new behavior prediction models, as well as devising models that allow us to compute how to intervene to steer the behavior towards desirable outcomes.

Believe it or not, we are already there with our phase three ***Proximity Social Beacons*** and ***information sniffers***.

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CommSmart Global Group – Digital Dialogue Center

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WE ARE IN THE *NOW* AND KEEP YOU; *IN THE KNOW*…

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