
Night Beacon: A system to empower people to walk with confidence at night

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Abstract

A system that encourages people to walk more at night—a time when many people choose not to go outside—is one way to increase citizens' health and activity and revitalize nighttime urban areas. We propose Night Beacon, a system encouraging urban pedestrians to walk at night, without having to walk alone. The system uses researched disparities in confidence between pedestrians to create natural, helpful walking groups. Night Beacon also provides night safety and night activity information to help inform users about their nighttime environment. It incorporates trust-building features in order to support user confidence, reputation, and accountability. Night Beacon's "badge" allows seamless social interaction when groups are formed. The community would be composed of smart phone users that are currently out in a given area. With more people able to walk at night, cities can benefit from a positively thriving night economy, and its citizens can feel healthier, happier, environmentally conscious, and most of all, safer.

Keywords

Night walking, night safety, mobile technology, badge identification, online communities, group formation



Figure 1. Research on the broad problem of walking at night and "Badge" social experiments on interacting with strangers

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Each day, people in the United States travel 26.2 billion miles by walking [1]. Due to perceived dangers about crime and safety in urban areas, research has shown that people may choose to walk less at nighttime than in the daytime [2]. With lower visibility, fewer people and businesses active, and the perceived threats of personal safety, there are many reasons a walker may feel uncomfortable walking at night.

At the same time, the nighttime economy, culture, and society of urban centers have become increasingly popular. Cities benefit from an active nightlife through greater opportunities for businesses and more active, involved citizens [3]. Yet, because people work during the day, early morning or night may be the only opportune times for personal activity. Additionally, fewer people are able to be active during work.

Despite the demand and popularity in nightlife, barriers such as personal safety cause people to reconsider going out. Additionally, people in the US are trending toward walking less. In 2000, regular travel to work by car had risen, at the expense of walking and public transit, to 88%, from 67% in 1960 [4].

The dictionary defines a beacon as "a person or thing that serves as a guide, inspiration, or warning". Night Beacon attempts to empower less confident individuals to walk at night by grouping them with more confident individuals. Our proposed system helps people find groups and encourages walking, re-introducing

pedestrians into city spaces after hours and helping change perceptions of walkability at night.

Research: Contextual Inquiry

In the early stages of our project, we explored the issue of walking at night. We employed user-centered design research methods, including contextual inquiry, to find out about peoples' general attitudes and behaviors about walking at night. We interviewed 8 individuals who walk more than 10 hours per week, which we defined as "active walkers". Following the interviews, our team captured affinity notes and arranged an affinity wall.

We also conducted six field tests and an online survey of 100 users through Amazon's Mechanical Turk. Both of these studies explored users' attitudes and perceptions regarding trusting and interacting with strangers. These tests were predominantly used to evaluate our "badge" feature.

In our field test, participants were instructed to walk to a destination with a paper "badge". A "stranger", who was one of our team members with whom the participant had never met before, held an identical badge. We minimized bias by providing no information about the expectation of the encounter, or purpose of the badge. The participants were then asked about their experience interacting with a stranger.

From our online survey, we learned that a badge symbolizes a commonality that people share with others. We also gained insights that a badge signifies access or a qualification to a limited resource.



Figure 2. Part of the affinity diagram

"I don't walk a lot during daytime because I don't want to get sweaty before work" -U02, from our contextual inquiry

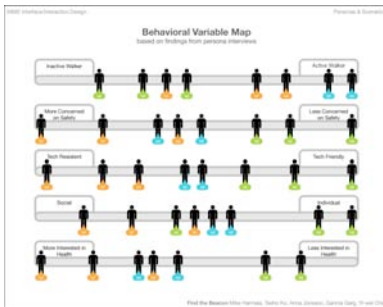



Figure 3. Behavioral Variables Map which highlights the important patterns of users' behavior

Christina Moletti
Freelance Graphic Designer



"Living life is a creative process too"

- Has enough money but not much more
- Works hard during the day but on her own hours
- Walking is her main way to travel, day or night

Personal Information

Age: 25
Location: Pittsburgh, PA
Education: BA Graphic Design NC State University,
Profession: Freelance Graphic Designer, Part-Time Student
Home life: Lives with a roommate (Eva 25),
Hobbies: Playing guitar and xylophone, reading, drawing, sewing, watching movies, sleeping
Favorite TV shows: Doesn't watch much TV
Personality: Easygoing, outgoing, try new things

User Goals

Christina uses this information system to...

- Give her reasons to go out walking at night

Figure 4. Abridged version of the description of our primary persona, Christina

We found that our respondents walk at night after working late, staying downtown with friends, or using the library until later hours. Some people would like to walk more for exercise, but cannot walk at certain times because it may be uncomfortable or inconvenient. Barriers to daytime walking include working the whole day, avoiding sweating before work, or going to a nighttime event. All interviewees also reported that they find mental health and calmness from walking at night.

Though we discovered that walking is a solitary and tranquil time for some people, we found out that others consider walking to be a social activity. With this insight, we questioned whether walking with others could be made into a positive opportunity to meet strangers. Yet, the predominant response reported that people want to be selective about whom they walk with, and they prefer knowing some information about the individuals before meeting.

Perception of safety was one of the major constraints for our design. Some respondents talked about an area's "vibe"; this is based on, for example, street lighting and the number of people in an area. A "vibe" is a person's general feeling of safety and comfort in an area. From our field tests, we found that peoples' concerns about safety can be minimized by walking with others they can trust.

Additionally, people increase their confidence and comfort meeting strangers by recognizing a sense of commonality [5]. In this case, a sense of commonality is created through possession of the same "badge". Research has also shown that there is a lack of consistency between a citizen's perception of safety and

officially reported crime data [6]. We hope to reduce fear by better aligning the pedestrian's perception of safety with known data.

Design Process

From these findings, we created personas to help realize the users' desires, motives and attitudes. These personas were formed through our interviews with people and through existing demographic research on people walking at night.

The developed personas are:

- Christina Moletti, a freelance graphic designer, walks at night with friends, for fun and to exercise. Christina is cognizant of her environment based on past experiences avoiding or encountering nighttime strangers. She actively shares her whereabouts and activities with friends.

- Maria Nantes, a newspaper editor, is motivated to walk in the evening in order to stay healthy, both mentally and physically. She does not have much time to walk because she works most of the day. At the same time, Maria does not think walking at night is entirely safe.

- James Goeffsner, a senior engineer, tends to drive to his destinations rather than walking at night by himself. James tries to avoid what he perceives to be dangerous areas and stays aware of his surroundings. Additionally, James takes pride in helping others when he can. He has a sister and often thinks about women and their personal safety: "every woman is someone's sister."

From these personas, we realized that our design would need to satisfy the needs of Christina. We envision her

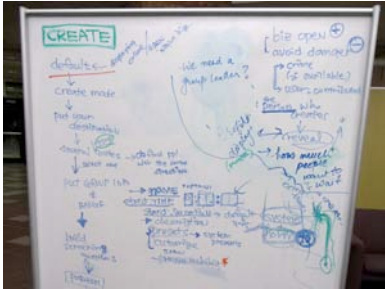


Figure 5. Ideation and whiteboard discussion session

as an active user, creating and joining walking groups. At the same time, we needed to address the reasons Maria and James do not commonly walk at night. James would need to be motivated to use the application, thereby helping people, meeting people, and walking more. Additionally, Maria would need to benefit from being able to walk at night by finding active, friendly people like Christina and James.

We developed our design following an iterative process of idea formation, prototyping, evaluation and user testing. During the brainstorming and ideation phase, we focused on the following findings about peoples' night walking behaviors: 1) Actual and useful information about the environment, such as crime data and walkability data, may reduce fears related to walking at night; 2) When people are integrated into a community that provides a sense of commonality, they tend to feel more comfortable; 3) A reliable trust system may facilitate strangers to interact with each other and potentially form groups.

Our Solution: Night Beacon

We propose a mobile-based system called Night Beacon. The system attempts to empower people who are not entirely comfortable about walking alone at night. Night Beacon is a mobile application that will help the user find groups of people to walk with, help suggest walking routes, and help make the user more aware of the events and dangers in their environment.

Our goals when creating this system were to:

- 1) Make people feel empowered when walking at night or provide people with incentives to empower others;
- 2) Encourage people to walk more;
- 3) Build trust between the system, the user and other users of the

system; and 4) Make the design immediately significant to the user and keep that significance over time.

First, Night Beacon provides a visualization with information about open businesses and safer areas based on a walking score. We call this function the "Night Light" (see Figure 8). It is calculated based on various parameters, such as the area's amount of lighting, open businesses, and any recently reported incidents that might impact the area's security.

With this information, Night Beacon plans the safest routes to specified destinations at night. Users join or create a group to walk in the same direction, along the same route. Users will likely meet people they have never met before, but the system has several trust-building mechanisms that are used prior to meeting.

Trust System and Confidence

One of the main challenges in creating social situations between strangers is that people will likely want to be more comfortable with said strangers compared to others that are out at night. Due to concerns for personal safety, users will feel a need to depend on the system to supply a reasonable amount of trust. Users must first perceive that a given group's members are reasonable enough to meet based on compatible age, gender, and habits such as smoking and drinking. With this information, the user creates a mental picture of the individuals prior to meeting them. However, age, gender, and a name are not informative on their own and reveal private information. Previous research shows that a high level of control with regard to personal privacy is a necessary prerequisite for willingness to use the system [7].



Figure 6. Our low-fi and mid-fi prototypes. Hand-drawing(top-left), Working on Adobe Flash(top-right), Working on Android(bottom)



Figure 7. The Hifi prototype of the mobile version of Night Beacon.

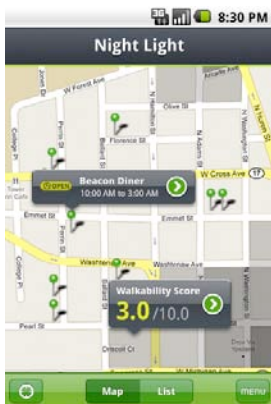


Figure 8. Night Light: Visualization on night walking information that shows active events, dangerous areas, walkability scores of an area at night.

This need for control implied using information that would not sacrifice additional privacy. We realized that our contextual inquiry led to an appropriate categorization, identifying each user by the following unique trust-based qualities: verification, recommendation, and experience. Verification provides a way for others to confirm that a particular individual is who he says he is. Recommendation provides a way for others to point out particularly positive encounters with an individual. Finally, a walker's experience level lets others know how many times this user has successfully completed a route through the system. With these qualities, users will be able to form better expectations about group members.

We also developed the "badge" feature in order to help ease social tension in the initial physical encounter between group members. By displaying the unique badge on the phone, the user nonverbally signals a group identifier for the other members to see and notice. Using the badge minimizes the possibility of misconceptions in identifying members, thereby providing a more seamless introduction between members.

Critical Mass

Users will not find group participation extremely valuable unless there exists at least one group in a given area. Furthermore, a group's route is most significant if it follows the same direction as the user's intended destination. So, the system is more likely to benefit people if there is a balance between users wishing to create groups and users wishing to join groups.

Our research has informed us that individuals will be more motivated to use this system and meet others if they develop a sufficient level of confidence. Users will not necessarily exert the effort to encounter strangers unless the opportunity provides more comfort than walking alone. Thus, Night Beacon's trust and badge features are intended to develop users' confidence in others so they choose group formation over walking alone.

There are also a number of ways that users can add personal value to the application, for example, by customizing their own profile or badge. They can build reputations through experience and user recommendations. Research has shown that identity and reputation are primary motivators for user participation and contribution in digital communities [8, 9].

Finally, "Night Light" further informs users about walking at night (see Figure 8). It entices users to become acquainted with the application, thereby providing walking and safety value, regardless of the number of groups in a particular area.

User Testing

We conducted our usability testing for our application in three prototype stages: lo-fi, mid-fi, and hi-fi. The lo-fi prototype was hand drawn based on initial research. We used it as a basis for discussing the interactive flow of the interface, and evaluated it based on Nielsen's ubiquitous ten usability heuristics.

After further refining concepts and interface elements, we redrew the screens and developed an Adobe Flash mid-fi prototype, which we tested with 8 different users



Figure 9. Walker Profile that shows our trust building system



Figure 10. Our usability testing in the wild(in situ)

"I could use this to walk into town instead of being in the mindset of driving everywhere"
-U04, from User Testing

in their mid- to late- 20s. Each user tested the interface and was asked questions regarding safety and trust.

We then built an Android phone application as a version of our mid-fi prototype. We conducted two nighttime field tests to learn about the physical experience of joining and creating groups, and to test the user's reactions to meeting strangers with the application. Through our tests, we confirmed that the system's badge function facilitates a more natural social encounter between strangers.

Conclusion

Through user-centered research, we discovered and analyzed needs that we can serve with a trust system for like-minded strangers: to walk, safely, at night. Night Beacon incorporates users' requirements for more specific information about others into a system, and allows them to find each other and walk together.

Our design requires users who are willing to participate in creating and joining groups. The system will therefore have to be both appealing to use and seamless in finding the right people to walk with each other. Night Beacon therefore balances the need to find people quickly with the opportunity for users to build and determine trust in other people. Additionally, Night Beacon incorporates "Night Light", which provides night walking data for a particular area (see Figure 8).

During our research, we learned that trust issues related to individual safety are deeply personal. Yet, Night Beacon allows users to identify characteristics among each other that would make walking together possible and even enjoyable. The feedback we received suggested that such a system is feasible, desirable, and

invites new ways of thinking about walking at night. Night Beacon would take careful consideration of peoples' needs for trust and safety. It would also make users more likely to visit their city spaces at night—reinvigorating local economies—while feeling confident, safe and happy as they walk.

References

- [1] U.S. Department of Transportation, Bureau of Transportation Statistics, *Transportation Statistics Annual Report*, Washington, DC, 2004.
- [2] Bennett, G. G., McNeill, L. H., Wolin, K. Y., Duncan, D.T., Puleo, E. et al. Safe To Walk? Neighborhood Safety and Physical Activity Among Public Housing Residents. *PLoS Medicine* 4, 10 (2007), 306.
- [3] Lovatt, A. and O'Connor, J., Cities and the Night-time Economy. *Planning Practice and Research* 10, 2 (1995), 127-134.
- [4] Brownson, R. et al. Declining Rates of Physical Activity in the United States: What Are the Contributors?, *Annual Review of Public Health*, 26 (2005), 421-43.
- [5] Currie, R. F. and Rondeau, D. Report for the City of Winnipeg Police. *Winnipeg Area Study Research Reports*, (1989)
- [6] Forde, D. R. Perceived Crime, Fear of Crime, and Walking Alone at Night. *Psychological Reports*, 73 (1993), 403-407
- [7] Yao, M. Z. and Linz, D. G. Predicting Self-Protections of Online Privacy. *Cyber Psychology and Behavior* 11, 5 (2008), 616-617.
- [8] Donath, J. S. Identity and Deception in the Virtual Community. *Communities in Cyberspace*. (1998)
- [9] Smith, M. A. and Kollock, P. *Communities in Cyberspace*, New York, NY, USA, 1999.