CommonTies: A Context-Aware Nudge towards Social Interaction

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Abstract
Urbanization has created transient, ethnically-varied, and densely-populated communities where meaningful human contact is difficult. Urban social norms such as "civil inattention" — a deliberate display of unwillingness to become more familiar with strangers — discourage social interactions among strangers [4]. While these norms help reduce anxiety or fear in overcrowded urban centers they hinder meaningful social interactions in public spaces (coffee shops, museums, and malls, etc.) and events (conferences, galas, etc.) where such interactions should occur. This paper describes CommonTies, a simple technological *nudge* that managers of *interaction spaces* and organizers of social events can use to leverage *contextual information* to encourage social interactions among strangers.

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H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Introduction
Consider two strangers, Wayne and Kent, stranded in an airport. They are traveling to the same convention and

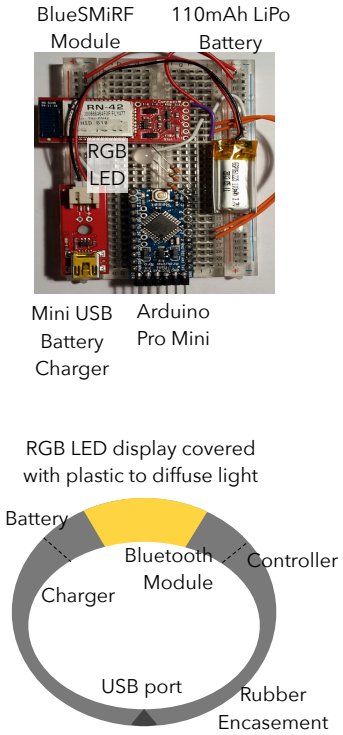

Figure 1: The Tie: A wearable physical wristband that syncs with other Ties to indicate profile matches and to suggest social interactions. Top: hardware prototype of the Tie.

their flights were delayed due to poor weather. Wayne and Kent are both wearing CommonTies: an innocuous colored wristband. As they separately make their way to the same airport coffee shop, their wristbands start to glow an emerald green. They look around to find the person whose wristband is also glowing the same color. Curiosity drives them to understand why their wristbands are *syncing* — displaying the same color. As they discover that they both are headed to the same destination, a conversation evolves that makes the waiting time pleasantly pass by.

The above scenario describes the operation and the design principles of CommonTies. Wayne and Kent were given a simple *nudge* — the wristbands or 'Ties' displayed the same color. No private information about the other person was exchanged and both parties could choose not to interact. Each Tie contains a Bluetooth device that uniquely identifies the Tie's wearer and helps keep track of his/her location. Check-in counters can distribute the Ties to passengers after encoding relevant profile-identification information in them. The airport coffee shop functioned as an *interaction space* and defined the context for social interaction: travel destination and flight delay time were used to construct *context-aware* user profiles. Different interaction spaces can use different profile matching criteria. For example, an airport exhibition could also be an interaction space and the Ties of passengers who paid close attention to the same display can sync.

Design and Technical Overview

CommonTies has three components: a wearable physical wristband called the 'Tie', the 'Beacon', and a context-aware profile-matching system known as the 'Matchmaker'. In the following sections, we describe each component and its design principles.

The Tie

Figure 1 illustrates a prototype of the Tie built using the Arduino platform. We chose this platform for its small form factor, low power usage and ease of programming. We plan on further miniaturizing our design by using the RedBearLab BLE (Bluetooth Low Energy) Mini, which also has a significantly longer battery life and allows more flexibility in the form factor. We also plan on adding two additional LEDs and covering them with a light diffusing plastic to soften the light, give a wider viewing angle, and improve the aesthetic appeal. Figure 1 outlines the fabricated version of the Tie.

Each Bluetooth-enabled Tie stores and transmits a unique identifier. No personal information is stored on the Tie. When two or more Ties sync, they receive a message from the Beacon with a color value to display. Ties signal a message back to the Beacon when a social interaction occurs: after a sync, two Ties handshake if they are at distance of two meters or less. If the Ties remain at close proximity for more than a minute, they send a message to the Beacon indicating a social interaction between the Tie wearers has occurred. To avoid user fatigue from too many syncs, Ties can only sync once every ten minutes. This time interval can be adjusted.

Look and Feel. Our design preserves the mental concept of the Tie as a clothing accessory and not yet another device. The Tie should therefore be lightweight and comfortable to wear. The Tie should not be distracting to the user or surrounding people: a soft diffuse glow is preferred over a glaring or flashing light signal. To encourage users to wear the Tie, we minimize the need to recharge it constantly by using components with low energy use.

Privacy Preservation & Nudging. In typical face-to-face interactions users can decide how much information they wish to reveal about themselves. To avoid modifying the nature of social interaction among strangers, we do not reveal user profiles to strangers. Moreover, by preserving our user's privacy, we allow more private individuals to comfortably participate in CommonTies. Also, since our goal is to subtly nudge and not force two users to interact, we only sync Ties by having them glow the same color and not sharing any other information.

The Beacon
Interaction spaces are spatially defined as the radial area around a Bluetooth base station known as the 'Beacon'. A typical Beacon covers an area of roughly $300m^2$. This means two Tie wearers are at most 20m apart in an interaction space. Larger interaction spaces will have more Beacons. When a Beacon detects a Tie it registers its presence in the current space and sends a message to the 'Matchmaker'. The Beacon constantly checks if the Tie is near. After a set time interval, if the Beacon cannot detect the Tie, it notifies the Matchmaker that the Tie has left the interaction space.

If the Matchmaker finds a match between two users in the same interaction space, it sends a message to the Beacon, which then alerts two Ties to sync. If an interaction does occur, the Beacon sends a message back to the Matchmaker confirming the interaction.

Interaction Space. The Beacon physically defines the limits of an interaction space and mediates social interactions. By using Beacons as mediators, we simplify the overall design, preserve privacy, and establish the notion of a safe and acceptable social interaction space. Suppose for the sake of argument, that there were no Beacons and Ties can scan other Ties in the neighborhood as well as share and match profiles, then syncs can occur in inconvenient locations such as public washrooms, rushed subway stairwells, lecture halls, etc.

The Matchmaker
The Matchmaker is a context-aware profile-matching system. It stores user profiles and associates each profile with the unique identifier of the user's Tie. Different user profiles are used in different contexts. Moreover user profiles can be built with or without the user actually defining a profile. For example, in a museum, as users wander around the displays, a user profile can be constructed automatically by sensing how long a user spent observing each display. This profile can be then used for syncing Ties at the museum cafe. Similarly, at a conference, user profiles can be built from conference proceedings, registration information, and talks that users attend. At the conference reception, this automatically-constructed profile can be used for syncing Ties. Alternatively, at a matchmaking party, Matchmaker can build user profiles from social-networking data (Facebook, LinkedIn, etc.) that the user allows Matchmaker to use. The core of Matchmaker is thus a context-dependent user profile database and a matching algorithm.

The matching algorithm allows users to configure a 'social temperament' threshold. Higher social temperament values will allow Matchmaker to match profiles with low similarity and lower social temperament values will cause Matchmaker to only match profiles with high similarity. Matchmaker can learn these values by observing how often a user follows through with a suggested interaction.

Matchmaker keeps track of Ties that have synced and interacted before and will not suggest these pairings again.

Unusual and Meaningful Interactions. CommonTies is a tool to expand social networks in scenarios where most people tend to interact within small social cliques. To achieve unusual interactions the Matchmaker tries to pair users who it believes do not already know each other, thus avoiding in-clique pairings. To achieve meaningful interactions, Matchmaker makes use of contextual information and a similarity matching algorithm tuned to each individual's social temperament. Without contextual information, pairings might be meaningless. For example, in a sports café, pairing two strangers who cheer the same team during a match is more meaningful to the them than pairing them off-season and in a different context such as a train station.

Related Work

Several works use bluetooth-enabled cellular devices to enable social interactions [3, 1]. CommonTies differs from such works in that we utilize a wearable accessory and we provide simple visual cues to initiate interactions. Unlike Serendipity [3], we preserve the privacy of our users by not revealing any profile information during syncing. Other works have studied the use of context-based technologies to enhance social interactions: Trainroulette [2] utilizes the context of a train and Mirkovic [5] utilizes technologies in a clinic to enhance patient-physician interactions. We generalize across multiple contexts and we enable social interactions among strangers. Paulos and Goodman use technology to detect the presence of familiar strangers in public spaces [6]. We define interaction spaces as spaces where we detect the presence of Tie-wearers to suggest social interactions.

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