



*Citation for published version:*

Patil, B, Kelly, R, Stanton Fraser, D, Gavin, J & Reddington, C 2016, 'Supporting Distant Familial Relationships with the Internet of Things', Paper presented at Ubicomp/ISWC'16 Adjunct, Heidelberg, Germany, 12/09/16 - 16/09/16. <https://doi.org/10.1145/2968219.2968343>

*DOI:*

[10.1145/2968219.2968343](https://doi.org/10.1145/2968219.2968343)

*Publication date:*

2016

*Document Version*

Peer reviewed version

[Link to publication](#)

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# Supporting Distant Familial Relationships with the Internet of Things

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**Abstract**

In this paper we discuss the opportunities of 'off the shelf' Internet of things technologies to be used to support closeness in interpersonal relationships. We give our motivation to study IoT on technologies to support distant interpersonal relationships. We present two designs, 'SmartLamps' and 'Connected Rings', which use IoT technology to foster experiences of relatedness between distant families. We present some of the challenges faced while evaluating these devices using 'in the wild' research.

**Author Keywords**

Internet of things; distant family relationships; awareness devices; closeness; in the wild study

**ACM Classification Keywords**

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

**Introduction**

Internet of things (IoT) technologies are reaching commercial maturity and will soon be part of people's everyday lives. There are more than 10 billion wirelessly connected devices in the market today, with over 30 billion devices expected by 2020 [1]. It is

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Copyright is held by the owner/author(s).  
*Ubicomp/ISWC'16 Adjunct*, September 12-16, 2016, Heidelberg, Germany  
ACM 978-1-4503-4462-3/16/09.  
<http://dx.doi.org/10.1145/2968219.2968343>.

### **Sidebar 1: SmartLamp System Evaluation Methodology**

#### **Research Questions:**

*Does the SmartLamp affect the feeling of closeness?*

*What are people's experiences of using the SmartLamp system?*

**Participants:** 6 pairs of parent-adult child dyads.

**Location:** Participants' home, workplace or any place that is meaningful to them.

**Duration:** 4 weeks.

**Data collection:** Diary study + Interviews

**Measures:** Quantitative data collected using the inclusion of other in the self (IOS) scale to measure closeness.

Qualitative data collected using interviews and open-ended questions in the diary.

anticipated that these devices will allow people to live more efficient and productive lives, and that new forms of interaction will be enabled by connections between everyday household objects (e.g. lights, fridges, heaters) and the world at large.

Our research is concerned with how IoT technologies might be used to support close personal relationships. In particular, we seek to understand how off-the-shelf IoT devices might be appropriated to foster feelings of closeness between people who care about one another but find themselves separated by physical distance. This follows a long line of research in HCI on technologies for the mediation of close relationships (e.g. [5, 6, 8]), but with a specific focus on the challenges and opportunities that may arise from the use of IoT technologies in domestic space. In the present paper, we provide an overview of our ongoing research, which is focused on the mediation of closeness between adults and their parents. We describe two systems (an IoT enabled lamp and IoT jewelry) that aim to support closeness through simple awareness and presence-in-absence. We end by discussing challenges we are encountering and which motivate our participation in the workshop.

#### **Background**

Feelings of closeness play an important role in people's lives and directly impact personal wellbeing [3]. This is evidenced most starkly by the loneliness and social isolation that people experience when they are separated from their loved ones [7]. HCI researchers have long been interested in designing technologies to overcome these challenges (e.g. [8]). Broadly, it has been recognized that technologies for maintaining relationships over distance need to create experiences

of *relatedness* by supporting feelings of social connection, intimacy, and closeness [5].

One way of fostering relatedness is to provide a simple sense of awareness about the activities of a distant partner [5]. Awareness in this sense refers to an "understanding of the activities of others, which provides a context for your own activity" [2]. Some work has explored designs that transmit explicit signals to share awareness of feelings and thoughts. For example, seminal work by Kaye et al. [6] describes a lightweight "Virtual Intimate Object" that allows people to convey simple "thinking of you" messages by clicking a small round icon on their computer desktop. Technologies such as these enhance closeness by creating a mutual understanding of a partner's behavior, replicating the experiences that might be enjoyed when people are physically co-present [5].

We are interested in how closeness might be fostered by devices that are explicitly presented as forming part of the IoT. On the one hand, this means appropriating objects that one might ordinarily find in domestic space, but with the aim of adapting their use to support closeness (rather than focusing solely on their utilitarian function, or how they might be designed to be "smart"). On the other, it may entail making use of devices that were intended for the automation of domestic activity, i.e. things that are meant to act on behalf of people, and exploring their suitability for mediating relationships. One challenge in this regard concerns understanding how these "proactive" technologies might maintain, but also disrupt, the fabric of relationships. Research has recognized that technologies for relating to others can have positive outcomes, but has also noted that they can easily

## Sidebar 2: SmartLamp Preliminary results

Some participant reported feeling more close:

*"I was just happy to know she was home really and felt close to her. You know we visited where she live and I could visualize where she was and she was fine and happy."* —P4.

Some participants felt a connection with the artifact:

*"I miss the lamp system, sometimes I find myself looking at the lamp wanting it to switch on. It was a nice, warm experience and I enjoyed doing it."* —P2.

Some parents reported privacy concerns:

*"I felt like I was intruding on her life. At first I felt a little awkward like it was information about her comings and goings that I wouldn't normally expect and felt a little bit like it was an intrusion"* —P1.

become outlets for the monitoring and control of people we care about [5]. Furthermore, the "always on" nature of contemporary communications media can lead to feelings of entrapment and obligation [4]. Thus, there is a need to understand how the use of IoT devices may align (or conflict) with the social practices that sustain caring relationships. Our research focuses on the specific case of parent-adult relationships as an understudied population within the literature at large.

### IoT Technologies and Closeness

Here we describe two systems that we are using to explore how the IoT might foster feelings of connectedness in parent-adult child relationships.

#### SmartLamps

This system makes use of a Belkin *WeMo*<sup>1</sup>, an off-the shelf IoT switch that is intended for the control of home electronics. In the SmartLamps system, the WeMo is used to control a small lamp at the parents' house. The switch is connected to their adult child's smartphone. The adult child can decide a designated place that is meaningful to them and when they arrive at that place, the lamp is automatically switched on at their parents' house. The adult child does not need to take any manual action to switch the lamp on as this is done automatically. When they leave that place, the lamp is turned off. The idea behind the concept is to afford the parents with an ambient awareness of the distant child's routine, and to explore the efficacy of this awareness for enhancing closeness.

At the time of writing, the system is being evaluated using a mixed-method "in the wild" deployment (see

<sup>1</sup> <http://www.wemo.com/>

Sidebar 1). The study has been running for one month, with 6 pairs involved. Three pairs are mother-daughter, two are mother-son, and one pair is father-daughter. All of these pairs are based in the UK. Five live in separate cities, and one live in separate homes in the same city. The adult children's age range from 21-38 years and parent's age range from 50-62 years.

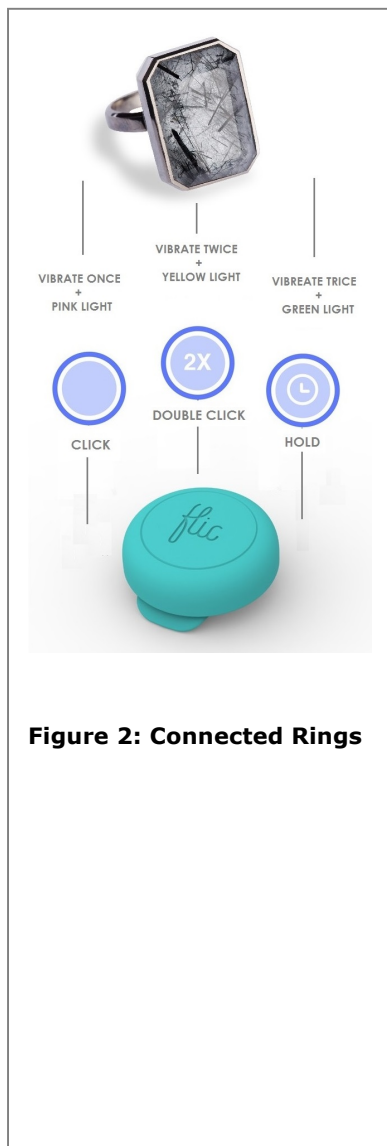
All of our adult child participants chose their home as the site at which to trigger the lamp in their parents' home. In this sense, the Lamps became a way for participants to convey a simple "I'm home" message to their family, which might also act as a trigger for further communication episodes (e.g. a phone call). In terms of exploring closeness, preliminary results from the study show that parents felt closer to their adult children on days when the smart lamps were activated. They also reported being more aware of their child's daily activities. All of the participants so far reported having more contact during the study period for various reasons. Some reported the lamp being a topic of conversation when family and friends visited, as they were intrigued and amused by it, indicating the potential for IoT technologies to support socialisation. Sidebar 2 gives examples of preliminary findings from the interviews.

#### Connected Rings

Our second system consists of two 'Connected Rings'. This system makes use of *Ringly*<sup>2</sup> and *flic*<sup>3</sup> wireless smart buttons. The Ringly system was originally designed to notify users of calls, messages and emails delivered to their mobile phone. However, our study

<sup>2</sup> <https://ringly.com/>

<sup>3</sup> <https://flic.io/>



**Figure 2: Connected Rings**

will use the rings to connect people over distance. Each adult child will be given a flic button. They will be able to press this button to convey one of three signals to their parent’s Connected Ring. When the button is pressed, the ring vibrates and a small ambient light is flashed (See Figure 1). There are 4 different vibration types and 5 different colors that can be combined to have different meanings.

Figure 2 shows this interaction design, with the button sending different vibrations to the ring that would be used to mean different things by sender and receiver. They could use it to create their own meaning to these three interactions such as ‘I am thinking of you’, ‘Busy’ or ‘Call me’. The intention of this study is to allow the adult child to have some control over the signals sent to their parents to allow connectedness in an unobtrusive way. As with SmartLamps, this system will be evaluated with a mixed-method field deployment, which is being prepared at the time of writing.

### Challenges

We faced several challenges with IoT devices for the ‘in the wild’ studies. At the moment most of the IoT products need a mobile app to get them working. Different IoT products have different apps and every time a user purchases a new product they need to install a new app. A mobile app called IF<sup>4</sup> (Previously known as IFTTT which stands for *If this then that*) allows some of the IoT and other online applications along with social media to be connected to each other, allowing them to work. However, not all IoT products are supported by IF, making interoperability a major issue for those who may wish to use these devices in

<sup>4</sup> <https://ifttt.com/>

their research. For example, the aforementioned *Ringly* is not currently supported by IF, requiring alternative ways to work with the flic button.

Another major issue is the reliability of IoT systems. We used IF to connect to the WeMo switch in SmartLamps. Although WeMo is supported by IF, initial pilot trials indicated that there was an issue with reliability when the WeMo was connected. Often the recipes did not trigger or there was a huge delay between the trigger and the action. This meant that there were occasions when the adult child arrived home, yet the lamp took longer to turn on in their parents’ house, creating confusion between participants. Sometimes the delay was more than 10 minutes and sometimes it did not turn on/off at all as the recipes did not get triggered. There were issues with connectivity in certain areas, sometimes making the SmartLamp system unreliable. Another issue faced during deployment was that, although WeMo is a commercial product, the instructions are not very clear, especially for users that are not tech savvy. The lead researcher needed to go to distant locations of parents’ home to set up the SmartLamp system and resolve any technical issues that occurred during the study.

### Conclusion and Workshop Motivation

Based on the research we have discussed here, we hope to make several productive contributions to the workshop. First, we seek to discuss challenges that we are facing with regard to the appropriation of IoT technologies for supporting relationships. As noted above, some of these challenges are technological, yet others are more pertinent to the question of how the IoT might support relationships; for example, several of our participants have already expressed hesitancy



**Figure 2:** IoT ring worn by a study participant

about the way in which the SmartLamp device impinges on their privacy. We are interested in discussing the way in which differing technical and social challenges are understood and managed by users in the wild. We are also encountering some general resistance to IoT technologies—several participants have expressed an unwillingness to adopt additional technology due to satisfaction with their current domestic routines. Since other social concerns may arise from technologies that act on behalf of people (as is the case for SmartLamps), we would find value in discussions regarding how the proliferation of IoT technologies could be productively reconciled with the needs of social relationships, given the broader context of domestic life. Our research would also allow us to engage in discussions about the practical aspects of evaluating IoT technologies in the wild, and to contribute to a set of best practices for others seeking to use commercial IoT products in their research.

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