

A Small Space for Playful Messaging in the Workplace: Designing and Deploying Picco

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ABSTRACT

We present Picco, a tiny situated display for drawings and simple animations, which are created on a dedicated tablet app. Picco was designed to support playful messaging in the workplace through a glanceable desktop device that would place minimal demands on users. Two studies of the device at work demonstrated how crafting was an expression of intimacy when the device was used to connect the workplace to the home, and a way of demonstrating skill and humor to a broad audience when messages were sent amongst co-workers. However, the level of skill needed to produce these messages became a barrier to entry for some co-workers. Our findings suggest that visible ownership of a situated device, which can be personalized in other ways, can underpin a secondary level of participation that is crucial in supporting a sense of involvement when the level of crafting required can stifle more direct participation.

INTRODUCTION

Situated displays in workplaces are typically used as indicators of presence and availability (e.g. [4]) rather than mechanisms for creativity and fun. In this paper we present Picco, a miniature situated display that supports messaging through playful animated drawings. Picco's design reflects many of the principles of situated messaging devices that have been explored through HCI research, especially those designed for the home [8,12,17]. However, we designed Picco to be used in the workplace. We describe the design decisions that were taken in order to support playful messaging in this context, and report findings from two field deployments, through which we explored whether Picco would be accepted and valued by office workers.

Workplaces are a site of play and banter as well as of work [15]. Informal exchanges occur face to face as well as through technological mediation [10,11], and they have an important role to play in supporting workplace cohesion,

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the exchange of work-related information, and in simply bringing enjoyment and a sense of fun to the workplace. However, technologies that explicitly support playfulness are often discouraged at work, and workers are unlikely to make visible the fact that they are using communication technologies for purposes other than those that are strictly work-related and functional.

It is within this context that we designed and built Picco (Figure 1). Picco is an explicitly playful device, and one that is permanently on show through its positioning on workers' desks. However, it was also designed to be non-disruptive and non-demanding. Its small physical size allows Picco to blend unobtrusively into the contents of an office desk. Messages are delivered through a queuing system that discourages the sending of time-critical content. Alerts are subtle and can be acknowledged with a simple tap; more elaborate responses are not catered for. Through deploying Picco in the workplace, firstly amongst a group of interns, and secondly with office-based workers who used the device to communicate with family members at home, we explore whether a device that is explicitly and visibly about playful communication can find a place in the workplace, and if so, what value this brings to its users.

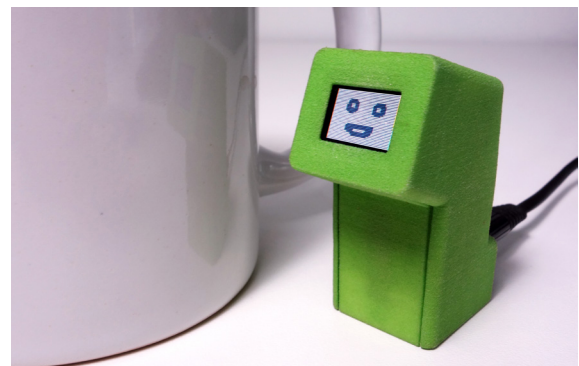


Figure 1. Picco device next to a coffee cup.

In the following, we outline prior work that informed the design of Picco, before describing it, along with the associated app and server infrastructure, in more detail. We then report findings from the two field trials, before discussing consistencies and differences across them.

RELATED WORK

Given our research aims, we draw here on three key bodies of work. Firstly, we consider design for playful forms of

interaction, specifically in the workplace. Secondly, we look to prior examples of situated messaging devices and what we can learn from their deployments. Thirdly, we review research on messaging through pictures and drawings, and the technologies that support these types of communication through touch interaction.

The importance of playful and informal interaction at work has been demonstrated in contexts ranging from factory work [15] to office work [11], and has been shown to underpin affinity and trust and to serve as a resource for more direct work-related communication. This is important since even collocated colleagues can find it difficult to keep abreast of each other's activities, both work-related and socially [3]. However, it is more usual for work communication technologies to be appropriated for social purposes, rather than to be designed explicitly for this. For example, Nardi et al. [11] describe how instant messages support both work-focused interaction and what they term 'outeraction', which includes flirting, joking, and chitchat; and studies of work-provided camera phone use amongst nomadic workers highlights their role in sharing amusing messages and images [9]. Examples where research prototypes have been used exclusively for play in the workplace include Mentis et al.'s [10] study of *Take and Give*, a phone app that enabled users to 'pickpocket' images from one another. Here also, the technology was found to support a sense of connectedness amongst co-workers, although the need to attend to the device introduced potential distractions from work. A more functional workplace situated display was presented by O'Hara et al. [13], who note how workers oriented themselves and their social actions to the functionality and visibility of the display.

Of course, any communication technology might be appropriated for playful purposes. For this review, we will focus on what is known about situated messaging devices and picture messaging, both of which are relevant to Picco, and both of which are strongly associated with play. Perhaps most relevant here is *Wayve* [8], a situated messaging device for the home that incorporates handwriting and photography. Lindley et al. report how, in a study of 24 households, *Wayve* was found to support various types of playfulness, from teasing and displays of wit to gameplay. A number of features of the design were found to support playfulness, but the combination of flexibility and constraint was especially emphasised; flexibility was afforded by freehand input, while a limited colour palette and fairly small screen, as well as its location in the home, introduced constraints. Drawing on philosophical and psychological accounts of play, Lindley et al. describe constraints as facilitating playfulness by providing the freedom but also the security to experiment.

The playful behaviors that Lindley et al. [8] report resonate with research conducted with a number of similar situated messaging devices. *TxtBoard* [12] and *HomeNote* [17] both fostered playful interactions amongst family members by

enabling them to message a display located in the home. Both were also used to send messages simply expressing the sentiment 'I'm thinking of you' – called 'social touches' by the researchers – and 'broadcasts of identity' – messages sent to celebrate or share one's identity, such as self-portraits drawn by the children in the home. In each case these devices tended to be used in addition to, not instead of, the communication technologies that were already available such as mobile phones and computers. They introduced a channel that was shared amongst all family members because of its physical location in the home, but was private to the family. Similarly, Rowan and Mynatt [14] used a situated display as a private channel to support social connectedness between parents and their adult children.

A final technology worth mentioning in detail is *12Pixels* [19], a social web service that allows users to create and share drawings using a mobile phone app. The proliferation of tablets and phones with touch screens has led to a number of services that support drawing, and this form of input has been noted for being seen as more personal than text- and even photo-based status updates (e.g. [5]). *12Pixels* is interesting because it relies on keypad interaction, yet in spite of – or perhaps because of – this constraint, it encourages the making of very intricate pictures. While the analysis of *12Pixels* usage focused on overall trends rather than how users experienced the service directly, it once again highlights the level of creativity and playfulness that can be enabled by providing a relatively limited interface. We know little about how *12Pixels* was used to communicate, and apps that support drawing and painting have received little attention from HCI researchers. However, we might expect this type of messaging to resonate with what is known about picture messaging more generally, where images tend to be used for affective rather than functional purposes [7], and serve to support communicative richness [18], even when they are simply used as emoticons [1,16].

DESIGNING PICCO

These prior studies and prototypes show how the use of drawings and pictures can support playful and expressive messaging, and how this can be facilitated further by the use of appropriate constraints. Research has generally examined playful and informal communication within families and other intimate contexts, yet workplaces can also benefit from this type of interaction. However, designing technology to balance the opportunity for playful messaging with the requirements of the workplace is complex. The desire for social contact throughout the workday (e.g. [2]) needs to be offset against a need to maintain focus on the job.

Picco was designed with these different requirements in mind. We wanted to avoid distracting users, and to minimize any requirement to monitor Picco. There are other channels available for urgent or important information and we did not envisage Picco as an appropriate way of sending time-critical messages. Accordingly, we designed a device

that was always available and could easily be glanced at, but would otherwise fade into the background. Further, we designed Picco to support asymmetrical communication; by supporting only a very lightweight means of response – a tap – we hoped to reduce any sense that messages could be burdensome in requiring a reply. Finally, we built Picco as a separate device from the user’s primary work system to reinforce the idea that it offers a secondary channel of communication. In the following sections we describe how we hoped to create a design to meet these constraints.

The Physical Form of Picco

We designed Picco (Figure 1) as a physical device to emphasize its nature as a separate and always-on channel for communication. It looks like the sort of ornament or decoration that might be commonly seen on an office desk. It is small compared to other computing devices at just 4.5cm tall, which allows it to be visible at a regular desk-to-chair distance, but importantly also enables it to fade into the background, and to avoid taking up too much desk space.

We intended for the shape of Picco to be slightly anthropomorphic, with Picco’s ‘face’ staring up at the user. This adds to its playful character, but the design was sufficiently stylized to not appear too toy-like. Piccos are constructed in a variety of colors, so that users can tailor the appearance of their own device. We hoped this would increase its acceptance as well as add to its ‘personality’.

Messaging via Picco

The physical design also reflects the fact that we envisioned Picco to be primarily used for picture messaging. Messaging using images provides an interesting alternative to text, as the constraints of an image preclude dense informational content and instead encourage creativity and playfulness. We also felt that the display of images, crafted by others, would support the sense of Picco as a desk ornament. Because we did not imagine the device to support important communications, it shows only the most recent image that has not yet been acknowledged (more details on this are given in the *Message Queue* section below). Therefore, and unlike other situated devices such as Wayve, the user is not presented with a slideshow or timeline of previous messages. However, the fact that only one message is displayed at a time means that they can be comprised of multiple frames. We designed the Picco device and accompanying app to enable the sharing of both static and animated drawings. These messages (‘picclets’) can be comprised of up to five bitmap images. Below we describe the interface of the app and the technical details of the device, before describing how images are queued and how the user interacts with the device itself.

Picco’s Internals

The Picco device is about 4.5cm tall, with an OLED display that measures approximately 1.2x0.9cm with a 52x36px resolution. The device casings are 3D printed and house a Wi-Fi radio, accelerometer, linear resonance actuator for vibration, and a processor running the .NET Micro Frame-

work. Custom software was written to run the devices. Picco maintains a persistent HTTP connection to a cloud-based web service and receives picclets as they become available. The picclets are decoded and rendered on the device.

An App to Create Picclets

The app to make picclets was built for Windows 8 PCs, and was designed both for touch- and non-touch devices. It was written using the Windows Store APIs, and communicates with a web service running on Microsoft Azure.

The app’s home page (Figure 2) shows each Picco that the user can send messages to, and displays each Picco’s current position in the queue of picclets. The picclet inside the Picco display is the one currently on the real Picco’s screen. Picclets to the left of the Picco display have not yet been seen, and picclets to the right have been seen and acknowledged, and are no longer displayed on the device. The user can tap the ‘new’ icon to the left of each Picco row to create a new empty picclet, or can make a copy of a picclet by clicking it to open it in the editor.



Figure 2. Picco app home screen.

The picclet editor (Figure 3) allows for simple bitmap image manipulation, including drawing using different brush sizes, shapes and colors. Drag-and-drop behavior is available for moving rectangular regions of an image, such as for simple sprite-based animation. When creating a picclet, a user can specify the duration each frame should be displayed for (from 100ms to 5 seconds).



Figure 3. Picclet editor.

Once a picclet has been created, it can be previewed – including any animation – and the user can select which Piccos should receive the picclet.

Picco Notifications

Picco was designed as an unobtrusive device. It is small and intended to be kept in the periphery of one’s awareness. However, this unobtrusiveness also means that it is difficult

to notice when new picclets arrive or are waiting. There was a tension between making users aware of waiting picclets and not presenting too many notifications – or otherwise designing an ‘attention-grabbing’ device.

We decided to adopt the following behavior: when a picclet is first displayed, the Picco vibrates briefly. We designed the vibration to be subtle but noticeable. Every 30 minutes thereafter the vibration is repeated. Once the user acknowledges the picclet then the vibration ceases until a new picclet arrives, when the process restarts and the Picco vibrates again.

Message Queue

The small display and limited interaction mechanisms available on the Picco device provided some challenging design constraints. We wanted to enable sending multiple picclets to a device, and to deliver them in a consistent manner, but without requiring a complex interaction scheme to navigate between the picclets. Additionally, from conducting pilot trials with our coworkers we noticed that there was significant complexity involved in understanding which picclets were still waiting to be displayed, especially when multiple users were sending to any individual Picco.

Ultimately we decided to maintain a simple queue-based metaphor for picclets. As picclets are sent to an individual Picco they are placed at the end of the queue, and the Picco moves through this queue one picclet at a time. In keeping with the simplicity of the Picco device and its interactions we decided to only enable forward navigation through the queue of messages. A user double-taps the top of a Picco to ‘acknowledge’ a picclet; once a picclet is acknowledged the Picco will move along in the queue if a newer picclet is waiting. Additionally, the sender’s PC displays a ‘read receipt’ to indicate the picclet has been acknowledged.

Within the app, however, the user can view the queue and get a sense of where the currently displayed picclet fits into that queue. A user cannot use the app to control their Picco’s place within the queue; this requires tapping the device itself. The app shows a maximum of 20 picclets for each Picco – older picclets are not made visible or available.

Appropriation of Messages

Users are also able to open existing picclets through the app, and then either reuse (resend) them directly, or modify them in some way before sending them. We intended this to be used for the reappropriation of picclets – for example, to animate a static picclet, or to add elements to an animation.

FIELD STUDIES OF PICCO

Having developed Picco according to these design principles, we conducted two parallel field trials with separate groups of individuals in the workplace. Our aims were, firstly, to understand whether a device that we had designed to be explicitly and visibly about play would be accepted and used in the workplace and, secondly, to understand what value it might bring to users in this context.

We studied two different setups involving the device. Firstly, we deployed it with a group of interns, who were working in the same building for three months, with the aim of understanding whether the device could be used to support creative and playful communication amongst co-workers. Secondly, we deployed it with office workers and their families in order to explore whether Picco could be one means of connecting work and home. In the following, we describe the method used in each field trial, followed by an analysis of the ways in which Picco was used and appropriated in each study.

Method for the Field Trial with Co-Workers

Participants

This trial involved 16 temporary employees: 7 female and 9 male. The interns had come from a variety of countries to work in a large corporation for approximately three months. Before working together most of them did not know each other, nor did they have family or friends living locally, so they presented an interesting opportunity to study the use of Picco amongst temporary employees with limited local social support. All participants worked on-site for the duration of their participation in the trial, although they were not all part of the same team. Most participants took part in the trial for 3-4 weeks, but two participated for only one week due to the timing of their employment. Not all participants’ trials overlapped; rather, participants joined and left the trial as their employment situation changed. Participants in this trial were not compensated for their participation.

Procedure

Participants were given one Picco each, in a color of their choice, and the Picco app was installed on their work desktop PC. In most cases these desktop PCs were not touch-enabled and so participants used the mouse to create picclets. However, the Picco app was also installed on a 55” touchscreen PC in a communal area for participants to use.

Participants were provided with basic instruction on how to use the app and the Picco device. They could send picclets to any other active Picco within the trial, and consequently could also see the message queues for all other participants through the app (although they did not know who the senders of these picclets were). Participants were informed that this was an exploratory study, and so we were interested in their thoughts on the device and app as well as how they used it. We fixed device, app, and server bugs as we discovered them.

Data Collection and Analysis

Our data collection procedures were threefold. Firstly, we maintained informal discussions with participants throughout the trial and recorded suggestions, bugs, and information and examples about their usage of Picco. We kept field notes about these discussions. Secondly, we conducted a series of focus groups with participants at the end of their involvement in the study; these focus groups were recorded and transcribed. Thirdly, we logged the messages and responses from participants and used these to assess their use

of the system as well to act as prompts during our interviews and focus groups. We used thematic analysis to categorize picclets sent during the trial based on their tone and content, and to analyze feedback and comments made by participants in the focus groups. We also presented the picclets to participants during the focus groups and asked for relevant contextual information about the picclets and the responses they elicited, and probed for opinions and experiences about the usage of the devices and the app.

Method for the Field Trial with Families

Participants

Eight families volunteered for this study, each of which had one family member working at the same corporation. Families were of different configurations (Table 1), although many included a partner and children who were at home for much of the day either to work from home or for childcare. All children in the trial were under 10 years old. Although we tried to recruit female workplace participants, none were able to join the study; however the genders were balanced overall. Participants in this trial were provided with an Amazon.com voucher in exchange for their participation, but we did not incentivize system usage or picclet creation.

Family	Workplace Participant	Other Family
F1	Father	Wife, 2 children
F2	Father	Partner, 1 child
F3	Father	Wife, 1 baby
F4	Husband	Wife, 2 parents
F5	Father	Wife, 1 child
F6	Father	Wife, 2 children
F7	Husband	Wife
F8	Father	Wife, 2 children

Table 1. Family trial participants.

Procedure

Families were given two Piccos each – one to keep at home, and one to keep on the office desk of the working family member. Families were able to choose the Picco colors.

Each family participated in the trial for approximately four weeks. A researcher visited each household at the beginning of the trial to set up the Picco and associated PC app. All families used a Microsoft Surface RT tablet to run the app. During this initial visit we conducted a brief interview to understand the family’s communication practices and daily routines. Family members were given basic instruction on how to use the device and app. At the conclusion of the four-week trial we visited the families again to ask their thoughts on the Picco system and to understand their usage.

Part of our aim for the family deployment was to explore the asymmetry inherent in Picco’s design. Families were initially instructed that this system was intended as a one-way channel between home and work; as such, the only PC that could send picclets was kept at home. However, approximately two weeks through each trial we offered partic-

ipants the option of having the app installed onto their office PCs as well. Family members could send picclets to either Picco from any device that had the app installed. It was not possible to send picclets to other families’ Piccos.

Data Collection and Analysis

As in the co-worker trial, we used several sources of data for our analysis: we conducted interviews with each family; in many cases had ongoing conversations about feature requests and bugs; and we also used data logging throughout the trial. The analysis followed the same process as described for the previous trial, and once all data had been collected from both trials, this was analyzed together so that common patterns and differences could be identified.

Findings from the Field Trial with Co-Workers

Across the entire intern group, a total of 109 unique picclets were sent throughout the trial (123 including resends). On average, therefore, each participant sent around 7 picclets (median 4.5). One sent no picclets at all and the most prolific user sent a total of 30 picclets. In addition we observed a strong novelty effect: 93% of the picclets were sent in the first two weeks of the trial.

Many picclets sent early in the trial were attempts at using Picco as a messaging medium, either by engaging in a conversation or provoking interaction. Participants quickly learned, however, that the design of Picco did not lend itself to this sort of functional use. For example, one participant sent a picclet subtly encouraging other interns to join her in going punting (Figure 4) but did not get any responses. As a result she decided that the public nature of the device and the app discouraged functional communication and instead created animations and more playful content:

“So before I actually saw the app and what it looked like, I sort of expected that they could use it like (IM) and... send private messages. But when I saw that everyone can see your things, then I decided... to use it for fun and sharing sort of nice pictures and more generically” (IP5, female).

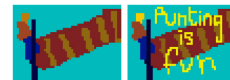


Figure 4. Subtly gauging interest in a joint social activity.

A small number of participants quickly became heavy producers of picclets, and although Picco and the app did not reveal their identities, some nevertheless gained a reputation as expert users, and their intricately crafted picclets were a source of admiration and conversation. Overall, however, most participants did not contribute a great number of picclets into the system; many only sent one or two over the course of the trial. This was partially related to the fact that the aforementioned heavy users created very impressive picclets, and other participants felt they could not match the quality level that had been set – at least not within the time they were prepared to spend. Rather than send inferior messages, they decided not to send content at all, and to act as consumers of content instead.

A second reason for the limited amount of content creation was that almost all of the interns worked in open-plan areas:

“I think that I got a little bit shy because my table’s right in view of everyone that walks past, and I didn’t want to look too much like I’m skiving the whole time when I’m just sitting there doing my picclets.” (IP3, female)

As a result, participants felt social pressure to avoid drawing picclets, or to draw simpler picclets that were seen to take less time away from work activities.

Establishing Norms

Over time, the group developed a sense of what made a good picclet and what was less interesting. Intricate drawings and animations were highly regarded and encouraged, as were picclets that were amusing and relevant to the group’s interests, such as an animated Mario jumping to collect a gold coin (Figure 5).



Figure 5. Animated Mario picclet.

These values were developed through experimentation with the constraints of the Picco app and device, and also through participants building an understanding of what they liked to receive themselves: some picclets were simply less interesting to have on display than others. Some participants even took advantage of the ‘reuse’ feature to manage their own displays:

“Yeah, I think I just relied on resending one to (myself) if I wanted to see it (again).” (IP12, male).

The anonymity of picclets made them more intriguing and engaging. Discussions would take place over coffee breaks to try to determine who sent a particularly interesting picclet, or what it meant. However, the anonymity also put the viewer’s attention squarely on the picclet and its quality, rather than on the relationship that might give the picclet context:

“I reckon if we knew who they were from it would be a relational type thing, and it’d be like, this message is from this person, and so I’ll look at it anyway. But because they’re not... you don’t know who they’re from... therefore it becomes a display screen. It becomes, do I want to look at this picture?” (IP1, female)

When it came to the reuse and appropriation of picclets, every picclet was fair game; participants were happy to reuse and modify picclets as long as the adapted version fit within the bounds of ‘good’ use of Picco. Generally this involved some sort of humorous or subversive element; one participant drew an animated surfer (Figure 6, top), and another participant reused her animation but added a shark attack (Figure 6, bottom). Some participants noted that this resulted in memes developing within a series of picclets – similar but altered picclets created by different participants.

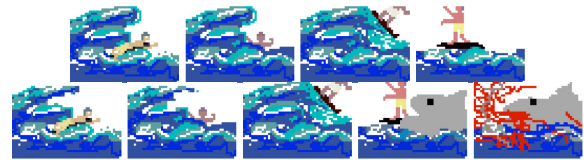


Figure 6. Initial (top) and appropriated (bottom) picclets.

Social Awareness and Group Cohesion

One design element led to a very explicit norm being developed; namely, the fact that the picclets are public (both in that they are displayed on devices on one’s desk, and that the recent history of picclets can be seen within the app) meant that it became important that picclets were sent to everybody rather than a subgroup of users. One participant described the awkwardness of realizing this:

“Last week, (two of the other participants) were going to the beach on the weekend, and so I sent them both an image of a beach. But I only sent it to those two. And then I thought, hang on, this is not good, cos... we had only one other girl who was on the system at that point, and she was new, and I thought ‘that was mean’ that I didn’t send it to her as well and that might make her feel excluded, so then I sent it to (her) as well.” (IP1, female)

Her fears were not unfounded, as other participants described that they would notice when these situations arose:

“If someone sends it to just one other person and I can go on the app and see what somebody’s latest message was that I didn’t get, if you see what I mean, so I know that they just got it just to them or just a few people.” (IP6, male)

As a result, almost all picclets were sent to everybody’s device; everybody knew what was going on and felt part of a wider group:

“Especially for all those groups things ... I mean, this is exaggerated, but you feel like the others are saying, there’s a community of interns.” (IP8, female)

This was particularly true when the picclets contained elements reflecting and reinforcing shared activities that the group members engaged in, such as going for beer or having lunch together. Group members also used picclets as a means of reinforcing a shared group identity through the construction and adoption of memes; animated picclets containing highly detailed drawings of videogame characters and online memes became a way of expressing the group’s common values (such as ‘geekiness’; see Figure 5).

Similarly, picclets were used as a means of broadcasting one’s own identity, and in turn, for other group members to get to know each other’s personality and values. One participant sent a picture of a beach to represent his coastal hometown (Figure 7, left), and this was understood by other participants to reflect his missing his home; another participant sent a modified version of her national (Indian) flag (Figure 7, right).



Figure 7. Examples of interns' expression of identity.

Participation and Ownership

Despite the fact that only a small number of participants were heavy creators of Picco content, the other participants expressed a fondness for their Picco devices and for simply acting as passive observers. Picco provided a flexible form of communication and play that was capable of supporting a variety of ways of interacting, and participants did not see themselves as being any less a 'user' simply because they did not contribute picclets themselves:

"(When I first got a Picco) it was super-distracting because I kept on wanting to draw stuff, then... other artists came along and I could just look at it and enjoy." (IP5, female)

These less active participants could still partake in conversations about picclets, appreciate the effort that the artists went to to draw them, and hold opinions on their favorite picclets. Additionally, even participants who did not engage in sending picclets still enjoyed having the physical Picco device on their desk. Piccos within the intern group were always 'owned' by an individual, and the individuals were able to choose their own Picco's color and placement on their desk. In addition to being a functioning communication device, it was *"a small cute desktop accessory"* (IP5, female) and also could be appreciated on that basis.

Findings from the Field Trial with Families

Overall families sent an average of 30 picclets per family (or 37 when including resends). As in the intern trial, some families showed much higher usage than others, although all of them used it to some extent: the family with the lowest usage sent a total of 17 picclets, while the most active family sent 51 (median 38). 75% of picclets were sent from home, and from our discussions with families we discovered that these were typically sent by spouses or parents; when children sent picclets it was generally at the parent's suggestion and with their help.

As in the intern trial, some families tried – and generally failed – to use Picco for functional purposes like reminding the working parent of items to pick up on the way home, or for announcing upcoming family events. However, as participants became familiar with the device and the app, they adjusted to the system's affordances and the types of communication that it suited. Rather than sending time-sensitive picclets, or messages that required responses, they focused on sending more playful picclets and 'social touches' that expressed the sentiment 'I'm thinking of you'. This does not mean that the messages were devoid of informational content; for example, the mother in family 2 sent her working partner updates of her and her daughter's day, such as being caught in the rain (Figure 8, left), and the home participant in family 7 used Picco to inform the workplace participant of an injury to her finger (Figure 8, right).



Figure 8. Status updates.

In both cases these were lightweight messages that provided a quick way for family members at home to stay in touch with the working parent, without the implied obligations that come along with other communication types. For some families though, the simple tap gesture used as a means of response was not enough and, in the absence of a full reply feature, they resorted to other channels of communication (SMS, IM) to provide feedback, thank the sender, or continue a conversation that had been started by a picclet. Other families, particularly the ones with family members who worked from home, appreciated the constraint and were content with a lightweight acknowledgement.

It is also interesting to consider the case of family 6. Before the trial, the father commented that he kept a strict separation between work and home – he had no photos of his family in his office, he rarely called home during the day (and when he did, it was for short, direct conversations with his wife about upcoming events or plans), and he focused entirely on working while he was at the office. However, when we visited at the conclusion of the study he expressed a great deal of affection for Picco and even wished that his children would send picclets more often. The design of the device – small, discreet, unobtrusive – and of the Picco system generally – placing an emphasis on short, playful, easy-to-understand messages – opened a small crack between home and work and a connection to his family even when he was deeply focused on his work:

"It was a welcome, um, not intrusion but an extension of... an extrusion of home life into the office, so that was nice." (F6)

In general, families did not make extensive use of the 'resend' feature of the Picco app. When they did, it seemed to be because they wanted to send *something* but did not have anything specific to say. For example, while the husband in family 7 was away on a business trip he used a rare moment of free time to quickly resend a picclet:

"I just remember sitting in a room... at 5:30 in the morning having breakfast at the crack of dawn before I was running out of the café to go upstairs, and I just did a resend." (F7)

This contrasts with the intern group's extensive use of the resending functionality to both manage their own Picco displays and to contribute to group memes and in-jokes. However some families appropriated Picco in a different way: by adopting a system of codes and symbols to condense information into animated form. For example, family 7 developed a way of asking "what time will you be coming home?" (Figure 9, left: 111 in binary is the number 7, which represents 7pm, the time that the husband normally would go home.) Similarly, the workplace participant in family 3 asked his spouse to watch a nearby windsock and

send him icons so he knew which way the wind was blowing for some work he did in the evenings (Figure 9, right).

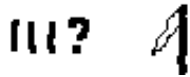


Figure 9. Codes and symbols.

We did not see this degree of coordination or familiarity in the intern trial; we expect that because the family deployments feature smaller, more intimate circles, codes and symbols are easier to generate and coordinate. Additionally, because of the way the interns broadcasted messages to everybody, there would be little utility in sending codes that only a subset of the participants might understand. This would essentially have meant forming a clique of those who understood the code versus those who did not. In contrast, families had more opportunity and more reason to develop and send more intimate and personalized picclets.

Device Ownership

We expected to see the two Piccos we gave to each family to be used to show the same picclets – acting as a mirror or shared link, or for sending a picplet to the home device to see how it looked before sending it to the work device. In fact, it was rare that the same picplet was sent to both Piccos. For some households the device provided a channel for messaging, with picclets being sent from home to work and vice versa:

“I think it was almost like a sticky note that you would put on the fridge, or something playful like a heart that I would send that said ‘I love you’ during the day.” (F7)

In other cases, families treated the Piccos as ornaments or toys. Children would send picclets to the home Picco and then run to the device to see them arrive, deriving pleasure simply from the act of constructing, sending and viewing picclets, even if nobody else was going to see them. These picclets took the form of simple doodles as well as more complex and meaningful images; in family 1, the daughter took delight in sending picplet after picplet of spiders, her favorite animal. We also identified examples of what Sellen et al. [17] refer to as ‘broadcasting identity’ – picclets that had no functional component but that served as a way for the sender to draw attention or to otherwise celebrate their identity, and usually sent to the home Picco. For example, the children in family 6 sent an animated series of flags as a picplet (Figure 10) to represent their multicultural heritage.



Figure 10. Family 6's flags.

At work, Picco was sometimes treated as a reminder or representation of family – as *“another thing that would sit on the periphery, being with these things that reminded me of home”* (F5), and at other times as a personal device that just happened to display messages from their loved ones. This

became particularly apparent in the color selection of the devices. Some participants chose devices in colors that they themselves liked and were happy to have on their desk or in their home. Others chose colors that represented their family or loved ones, such as a partner’s favorite color, as a reminder and an external representation of home.

Crafting and Gifting

There was a commonly expressed sentiment that designing picclets was a craft-like activity. This seemed to be especially amplified due to the physicality of the touch interface – one participant described the process of designing picclets as *“pushing pixels”* (F5), and the idea of literally pushing pixels on a touch-enabled display was seen as a compelling interaction modality, bringing an element of physicality to a digital crafting operation. The large pixels on the app’s drawing canvas enabled a degree of precision that allowed participants to spend time and effort designing pixel-perfect representations, if they so desired.

By their nature, the hand-drawn images in picclets were seen as both more expressive and more fun than text-based messages. Several of the family participants treated picclets as *“kind of like a gift, or something like a card that I designed”* (F7), and the emphasis on physically drawing picclets on a touchscreen led to a sense of picclets being crafted and worth *“spend(ing) a little bit of time over”* (F5). Some participants described drawing as having more expressivity than traditional textual communication. This was made explicit with drawn expressions of love, such as hearts and short ‘love notes’ (Figure 11).



Figure 11. Expressions of love and affection.

This gift-like nature lent itself to other uses as well. Messages that might otherwise be misconstrued as ‘nagging’ or too serious were tempered by being presented on the ‘cute’ and ‘playful’ Picco screen, in the same way that an emoticon might indicate the emotional context of an email. For example, the husband in family 7 sent an animated picplet telling his wife to get ready to leave the house (Figure 12):

“It wasn’t just a (message) that said, ‘hey, get in the shower and let’s get going’. It was more of a ‘hello, I love you’”.

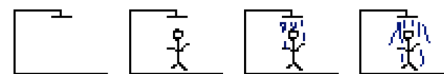


Figure 12. "Hey, get in the shower."

DISCUSSION

Our first aim in this project was to explore whether, by using a very small screen and designing to avoid intrusion and distraction, a device that would primarily support playful and informal messaging could be accepted in a workplace. Overall Picco was broadly accepted, and we found this to be the case even for participants in the family trial who previously kept clear distinctions between work and home. The

physical design of Picco meant that it easily fit in with other items on users' desks, and the behavior of the device meant that the arrival of new picclets was not distracting.

In both trials there were attempts at using Picco for functional communication, or for picclets where timeliness was important. Picco was not well suited to this type of communication, and participants rapidly realized that the affordances and behaviors we had built into the device and app made it inappropriate for important or time-sensitive messaging. After this initial experimentation, participants used it as a secondary channel for communication, one that was less distracting than other communication modes, and one that allowed for a degree of personality to be injected into the workplace through its physical presence.

Our second aim was to understand what value Picco brought to co-workers and to families. Our findings indicate that Picco was used and regarded in different ways across the two user groups. Families were generally happy to use Picco for intimate and personal messaging: children sent picclets broadcasting their identity, and partners sent picclets that were akin to love notes. While these messages were sent to workers in offices rather than an open plan area, and were not visible to Picco app users outside the family, the fact that these families felt Picco could act as a conduit for such personal messages is encouraging. The size of Picco meant that messages could be intimate even while ostensibly on display on one's desk. For some workers, Picco presented a small crack in the home/work boundary – enough to make them feel connected to their family while they were at work, and this was sometimes made salient by choices as simple as the device's color being their spouse's favorite.

However, not all participants viewed Picco in this way. Others saw it as a cute object or toy, one that displayed interesting, evocative or funny drawings and animations. These participants focused on Picco as a device rather than as a communication channel, and accordingly it needed to reflect *their* preferences. Its color was their own favorite and its display was curated to show whichever messages they wanted to have on display. For these participants, the device became less of a means of connecting with others and more akin to a picture frame. This mode of use was most obvious amongst the interns, who used Picco in a less intimate way, broadcasting well-crafted but impersonal messages to a large group. Given the open-plan area in which the interns worked, norms rapidly developed about who should receive what messages, and who might feel excluded if they did not. Cliques, therefore, could not be made visible through messaging; and rather than supporting personal communication, the emphasis became on the quality of the picclets themselves.

This leads us to consider the nature of picclets as a form of crafting and gifting. In both trials a subset of participants became particularly enthusiastic picclet creators, and the app's touch interface lent the process of designing picclets a

more explicitly physical feel. In families, the creation of personally meaningful and expressive picclets was a way of demonstrating intimacy and affection; although picclets are digital they have a hand-drawn character, and thus became 'gifts' that reinforced family relationships. For interns, the construction of highly crafted picclets was less about intimacy and more about demonstrating skill, wit, and an understanding of the values of the group. When interns appreciated these picclets they were admiring the effort that had gone into them, but not a deeper meaning or the reinforcement of a relationship.

The focus on picclets as works of art in their own right brought along a caveat: the interns set themselves such a high bar for the quality of picclets that few of them were able to match it, certainly not within the limited time they had available for making picclets while at work, and so usage was low later in the trial. We had designed the system to minimize distractions and the interface to be simple, but instead of encouraging simplicity in the creation of picclets, it presented a challenge to overcome. As with Wayve [8] and 12Pixels [19], constraints became the boundaries within which experimentation and play emerged. Importantly however, for those participants who did not actively create content, the personalization of one's Picco became a way of participating in itself. Interns felt ownership over and an attachment to their Picco through simple choices such as its color and what was on its screen. As such, even users who might otherwise have simply ignored their Picco became involved to some degree, with the device providing the opportunity to open up conversation at the very least.

Overall, Picco served dual purposes. At one level it was a conduit for personal, intimate messaging. At another level, it was a platform for the creation and display of intricate, clever, fun, and beautiful drawings and animations. The fact that the device could be tailored meant that it supported different degrees of participation; one could send carefully constructed messages to the whole group, or simply choose one of these from an existing pool and send it to oneself. By enabling the latter, other forms of self-expression became possible, such as through the personalization of one's workstation. It is worth noting that the fact that Picco was a situated display, rather than a website or app, was essential to this secondary level of participation. The sense of ownership that users felt in relation to Picco was key to underpinning an ongoing sense of involvement in use of the device, even when users were shy of sending messages.

Design Implications

From our experiences we can suggest implications that can be drawn for designers. First, *support varying degrees of participation and use*. In both trials, some users wanted to use Picco as an object to be admired or personalized, while others became involved in constructing and sending picclets (cf. Twitter usage [6]). The device had to support both.

Second, *consider the broader implications of simple interaction design*. Although our app was designed to make the

process of designing picclets as simple and quick as possible, this also led some participants to find alternative ways of achieving their goal of constructing intricate picclets, turning simplicity into a challenge to overcome.

Third, when designing communication devices, *consider whether to display contextual information and metadata*. A lack of sender information for each picclet meant that there was a level of playfulness around discovering or guessing the sender – but this also reduced the possibility for more intimate or functional purposes. The context that was implicit in the family trial led to a different type of messaging.

Finally, *consider how the physical space and the virtual space are public or private*. Having Picco on display was essential to supporting degrees of participation. However, in the intern trial, making all picclets publicly accessible through the app had the side effect that most picclets were broadcast to everybody, since they could be accessed by everybody anyway.

CONCLUSION

In this paper we introduced Picco, a situated device for displaying simple drawings and animations, created through a bespoke app. Picco was designed to encourage playful and expressive communication, and to do so in a context where such a thing is rarely supported through dedicated technologies: the workplace. Through explicit design features including a very small screen, asymmetry, and no guarantee of timely message delivery, Picco is ill-suited to exchanging functional information, but can display carefully crafted and playful animations. Two studies of the device at work demonstrated how crafting was an expression of intimacy when the device was used to connect the workplace to the home, and a way of demonstrating skill and humor to a broad audience when messages were sent amongst co-workers. Problematically though, the level of skill needed to produce these messages became a barrier to entry for some co-workers. Our findings suggest that visible ownership of a situated device, which can be personalized in other ways, can underpin a secondary level of participation that is crucial in supporting a sense of involvement when the level of crafting required can stifle more direct participation.

REFERENCES

1. Amin, A.K., Kersten, B.T.A., Kulyk, O.A., Pelgrim, P.H., Wang, C.M., and Markopoulos, P. SenseMS: A user-centered approach to enrich the messaging experience for teens by non-verbal means. *Proc. MobileHCI 2005*, ACM Press (2005), 161–166.
2. Beech, S., Geelhoed, E., Murphy, R., Parker, J., Sellen, A., and Shaw, K. *The Lifestyles of Working Parents: Implications and Opportunities for New Technologies*. HP Labs Tech. Rep. HPL-2003-88R1, 2004.
3. Bernheim Brush, A.J., Meyers, B.R., Scott, J., and Venolia, G. Exploring awareness needs and information display preferences between coworkers. *Proc. CHI 2009*, ACM Press (2009), 2091–2094.
4. Cheverst, K., Fitton, D., and Dix, A. Exploring the evolution of office door displays. In *Public, Community and Situated Displays: Social and Interactional Aspects of Shared Display Technologies*. Kluwer, Dordrecht, 2003.
5. Cowan, L.G., Weibel, N., Pina, L.R., Hollan, J.D., and Griswold, W.G. Ubiquitous sketching for social media. *Proc. MobileHCI 2011*, ACM Press (2011), 395–404.
6. Java, A., Song, X., Finin, T., and Tseng, B. Why we Twitter: Understanding microblogging usage and communities. *Proc. WebKDD/SNA-KDD 2007*, ACM Press (2007), 56–65.
7. Kindberg, T., Spasojevic, M., Fleck, R., and Sellen, A. The ubiquitous camera: An in-depth study of camera phone use. *Pervasive Computing, IEEE 4*, 2 (2005), 42–50.
8. Lindley, S.E., Harper, R., and Sellen, A. Designing a technological playground: A field study of the emergence of play in household messaging. *Proc. CHI 2010*, ACM Press (2010), 2360.
9. Ling, R. and Julsrud, T. Grounded genres in multimedia messaging. *A Sense of Place: The Global and the Local in Mobile Communication*, Passagen Verlag (2005), 329–338.
10. Mentis, H.M., Lindley, S.E., Taylor, S., Dunphy, P., Regan, T., and Harper, R. Taking as an act of sharing. *Proc. CSCW 2012*, ACM Press (2012), 1091–1100.
11. Nardi, B.A., Whittaker, S., and Bradner, E. Interaction and outercation: Instant messaging in action. *Proc. CSCW 2000*, ACM Press (2000), 79–88.
12. O’Hara, K., Harper, R., Unger, A., Wilkes, J., Sharpe, B., and Jansen, M. TxtBoard: From text-to-person to text-to-home. *Proc. CHI EA 2005*, ACM Press (2005).
13. O’Hara, K., Perry, M., and Lewis, S. Social coordination around a situated display appliance. *Proc. CHI 2003*, ACM Press (2003).
14. Rowan, J. and Mynatt, E.D. Digital Family Portrait field trial: Support for aging in place. *Proc. CHI 2005*, ACM Press (2005), 521–530.
15. Roy, D.F. “Banana time”: Job satisfaction and informal interaction. *Human Organization 18*, 4 (1959), 158–168.
16. Sánchez, J.A., Hernández, N.P., Penagos, J.C., and Ostróvskaya, Y. Conveying mood and emotion in instant messaging by using a two-dimensional model for affective states. *Proc. IHC 2006*, ACM Press (2006), 66–72.
17. Sellen, A., Harper, R., Eardley, R., et al. HomeNote: Supporting situated messaging in the home. *Proc. CSCW 2006*, ACM Press (2006), 383–392.
18. Volda, A. and Mynatt, E.D. Six themes of the communicative appropriation of photographic images. *Proc. CHI 2005*, ACM Press (2005), 171–180.
19. Willis, K.D.D. and Poupyrev, I. 12Pixels: Exploring social drawing on mobile phones. *Proc. PERVASIVE 2010*, Springer-Verlag (2010), 391–408.