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The Literacy Fieldtrip: Using UbiComp to Support Children's Creative Writing

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ABSTRACT
Fieldtrips, traditionally associated with science, history and geography teaching, have long been used to support children's learning by allowing them to engage with environments first-hand. Recently, ubiquitous computing (UbiComp) has been used to enhance fieldtrips in these educational areas by augmenting environments with a range of instruments, devices and sensors. However, the sorts of interaction design that UbiComp makes possible have the potential not just to enhance the value of educational techniques in known application areas, but also to expand the application of those techniques into new areas of curriculum. We report on a UbiComp-supported fieldtrip to support creative writing, associated with the learning of literacy skills. We discuss how the fieldtrip, designed and run in the grounds of a historic English country house with Year 5 UK schoolchildren, engendered interactions which changed both the processes and products of creative writing, with benefits for both teachers and children.

Author Keywords
Interaction design, ubiquitous computing, children, literacy skills, creative writing, qualitative study.

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

INTRODUCTION
Ubiquitous computing (UbiComp) technologies allow people to interact with computing in a variety of ways in their everyday environments via pervasive, wireless and mobile computing. Such technologies have important implications for education, and there have been a number of initiatives around eLearning and mLearning (including UbiLearning) to support children's education both inside and outside the classroom. Moving outside the classroom, of course, is nothing new. Fieldtrips have long been recognised as a useful technique for enhancing learning by allowing children to go outside and interact first-hand with an environment, be this an historical site, an ecology, or other. UbiComp, however, has the potential to extend and enhance fieldtrips in new ways. In particular, fieldtrips can be structured and delivered in novel ways which allow not just for support of the curricula traditionally associated with fieldtrips – science, history and geography - but other curricula where the application of fieldtrips has hitherto been less clear.

In this paper we show how UbiComp fieldtrips can be designed to support the learning of literacy skills. We created a fieldtrip for Year 5 children from Whiteley Primary School, Hampshire, UK. The fieldtrip involved the children exploring the grounds of a historic English country house, Chawton House, also in Hampshire. Chawton House, owned by the Knight family from the 16th Century, is associated with the well-known English writer Jane Austen, who used the house and its environment as inspiration for many of her novels. Working with the curators of Chawton House, as well as senior staff from Whiteley Primary School, we created a fieldtrip to encourage children to interact with this environment for the specific purpose of gathering data, ideas and inspiration for a piece of creative writing: a story.

We briefly describe the UbiComp system we developed, as well as the co-design of the fieldtrip. The bulk of the paper is dedicated to description and analysis of the fieldtrip around the key issue: how the interactions engendered by the system enabled new approaches to creative writing. We discuss children's interactions with each other, with the environment, with the system, and with their teachers. We show how these interactions changed the process of creative writing, giving rise to new kinds of stories. We also discuss

* These authors were based at Sussex University for the period of the research. Their affiliations are now the first given in each case.

the value of the fieldtrip for both children and teachers in terms of promoting literacy skills for this age group.

BACKGROUND

New technology is now enhancing learning in a number of ways. Handhelds, wireless and pervasive computing have been used in classrooms, together with sensors, RFID tags and objects including mats, bricks, cubes, etc., to enhance different kinds of learning [5, 10, 15]. At the same time, new technology also allows learning to move outside the classroom. eLearning, mLearning and UbiLearning facilitate this in different ways. eLearning is concerned with creating virtual spaces that can augment or even replace the classroom, including online learning, web-based training, and virtual classrooms and universities [1]. While eLearning concerns creating spaces for learning, mLearning looks at mobile devices to enhance learning while on the move [11], as does UbiLearning [13]. UbiComp-supported fieldtrips are one example of this latter.

Fieldtrips are a long-used technique predating UbiComp that reflects the importance of engaging with an environment, moving around it and discovering what it is about. Fieldtrips are often task-based, involving searching, identifying and counting, where checklists or sets of questions structure and guide the learning [16]. Recently, fieldtrips have been augmented with mobile technologies which can change the kinds of interaction that take place. These range from instrumenting woodlands [14] and providing children with various portable devices to explore and gather data about ecology without specific predefined activities, through supporting learning natural science via collaboration in the field [8], to allowing children to 'write digital graffiti' attached to the physical space in which it was created [3], supporting project-based learning.

Traditionally, fieldtrips have been used in science, history and geography curricula – and the above UbiComp-enhanced fieldtrips also apply to these areas. However, in the project reported on here, we were interested in how technology might enable the extension of fieldtrips into other curricula, showing how technology can help with repurposing and extending such known teaching methods.

A major skill to be taught to primary school children is literacy. Literacy concerns the abilities to read and write, which also informs listening and speaking. Literacy skills are developed over the six years of primary education in a number of ways including creative writing, storytelling and narrative. There has been a range of research into technology-enhanced teaching and learning to promote literacy skills. KidPad [7] enables children working together to use hyperlinks on a drawing surface to link ideas in support of narrative construction. KidStory [2] leverages collaborative learning of narrative construction through a range of shared input devices. Other approaches include developing systems that can listen to children as they write and provide feedback [4], and virtual environments that allow children to construct and tell stories [12].

To our knowledge, there has been no research on the application of fieldtrips to narrative, storywriting or creative writing. However, there is much potential for this technique, particularly for primary school children coming to the end of their first tranche of literacy skills education. The UK government's national literacy strategy states that such children should 'know, understand and be able to write in a range of genres in fiction and poetry, and understand and be familiar with some of the ways in which narratives are structured through basic literary ideas of setting, character, and plot' [6]. While other approaches to literacy skills education have emphasized collaborative mechanisms or virtual environments to create stories based on existing knowledge and reading, few have looked at the value of engaging with real settings in order to extend the range of knowledge and data that might feed into it. We were keen to explore the scope of a real setting, with a range of historical characters and stories attached to it, as a resource for exploration and inspiration leading into creative writing and supporting the learning of literacy skills in new ways.

DESIGNING THE FIELDTRIP

The literacy fieldtrip was designed and provided for Year 5 students at Whiteley School, Hampshire, over several months, through the partnership of ourselves; staff from Chawton House; and two senior teachers from Whiteley Primary School: the head teacher, Pam, and the deputy head, Leila, also responsible for literacy skills strategy across county primary schools (names of all participants have been changed). The literacy fieldtrip was part of a larger project, the Chawton House Project, whose aim was to engage with Chawton House to create a range of UbiComp-supported activities for different kinds of visitors, including schoolchildren. Through the process, we engaged with both the curators and the teachers in a number of workshops, and, alongside, decided on a system to build.

The system consisted of portable devices (PDAs) capable of delivering and recording audio and text. These devices, which could all be used at the same time, were linked to a location-sensing architecture consisting of GPS augmented by pingers (RF beacons used to indicate proximity to marked locations). This meant that people walking around the estate would hear and see material/information depending on where they were. The content was organised and delivered by means of an information architecture based on adaptive, physical hypertext, which is sensitive to prior locations and content already received by users. Users could record audio and text messages (or 'annotations'). The system logged movements plus these annotations and the results could be accessed both on the PDA and later by users as web logs collating their activities. A fuller technical description of the system can be found in [17].

One of the aims of our workshops with staff members of Chawton House, which ran alongside the design of this fieldtrip and closely informed it, was to establish 'content' that could be used for the system. Early on, we agreed with

Chawton House staff that their own stories, accounts etc. of the house, spoken whilst acting as 'docents' (tour guides) could be used as audio content. At the same time, we worked with teachers to develop the fieldtrip, allowing them to access and think about the use of this audio content, and how children might interact with different audio clips in the environment. In particular, the teachers decided upon the overall structure and nature of the fieldtrip. They produced questions, instructions and prompts for display on the portable devices, to which the children could respond in a variety of ways including listening to a docent's audio clips or making a recording. They also provided timings and sequencing of instructions. The research team assisted with overviews of available audio clips and scaffolded teachers in understanding what would be possible using the technology provided. In [9] we describe the co-design process with teachers and curators in detail.

THE FIELDTRIP

Overview and Methodology

The fieldtrip was designed to support children's literacy skills by providing input to a creative writing exercise. In the six months leading up to the fieldtrip, we organised three co-design workshops with staff from Chawton House, and three separate workshops with teachers from Whiteley School. Specific design activities within these workshops included working with maps, walking around the grounds, video presentations, discussions and interviews, demonstrations of system prototypes, brainstorming and the detailed design of content and experiences.

On the day of the fieldtrip, which was in three parts, there was an introductory session at the school before leaving for Chawton House. Soon after arrival, one of the curators took the children on a tour of the interior of Chawton House. This first part of the fieldtrip was not digitally augmented in any way and acted as an introductory activity. The curator, Sue, led the children around the house, telling them about important features and encouraging reflection on what they were seeing, for example whether the Knight family (the owners over some centuries) or their servants would use a particular part of the house and what for.

Next, the six children moved outside the house, forming three pairs: two groups of girls, and one group of boys. Using one portable device per pair, they explored the grounds, free to go where they wished, given prompts by the system. The purpose of this second part of the fieldtrip was to familiarise children with the grounds, finding out facts and stories the curators had told about it, to observe the environment closely, and to inspire their imagination and creativity. After this second part the three groups reconvened with the two teachers, exchanging their experiences and ideas, and the third part of the fieldtrip was set up. In this final part, each pair of children went to two locations for further investigation, to conceptualize their stories further. Each pair of children was followed by two researchers, one with a video camera, and the other with a walkie-talkie to contact teachers if required and to keep in contact with the technical team.

Directly after the fieldtrip we interviewed the children and the curators. On the day after the fieldtrip, we observed the children writing up their stories, and then carried out a group interview with them, as well as (separately) interviewing the teachers. All activities were videotaped. Video was digitized and transcribed. Much of what follows is based on qualitative analysis of the data.

Our focus in the following sections is on the second and third part of the fieldtrip, during which the children experienced the grounds of Chawton House as a digitally augmented environment. We also discuss the stories they wrote. The analysis is organised around three sets of experiences and three sets of stories corresponding to the three pairs of children.

Exploring the Grounds

In the second part of the fieldtrip, the children were taken outside the house. Each pair was given one of the portable devices. Although the devices were capable of recording both audio and text input, an important feature of the fieldtrip's design was that the children also had notebooks and pencils. Thus they worked with a mix of old (analogue) and new (digital) technologies. The children were asked to go where they liked, explore the grounds, and respond to the devices as appropriate. The teachers did not supervise the children.



Figure 4 (top to bottom):
(a) Guided tour of the house;
(b) Exploring the grounds;
(c) Reconvening;
(d) Focussing;
(e) & (f) Old and new technologies;
(g) Writing up

There was a variety of interactions between the children, the device and the grounds, supporting the children's engagement with the environment. The interactions were associated with finding out facts about the grounds, hypothesizing about the meaning or use of things, gathering sensory impressions e.g. sights and smells, and role-playing characters that might have passed through the gardens. The children were exposed to a range of stimuli, some physical and some digital, receiving prompts and questions, responding in various ways through text and audio. The following set of vignettes shows a diversity of activities, linked to the stories later written, the children using the information encountered, and ideas developed *in-situ*, in their writing.

The vignette below is representative of how children in a given location engage in a range of different kinds of interactions - with the device, with the environment, and with each other. On entering the location, the device displayed its name, and played an audio clip in which a curator introduced it and provided background information. The device then displayed a sequence of instructions. Further instructions would only appear once children had affirmed that they had finished with the current one. Some instructions only appeared after a deliberately designed delay to give children the opportunity to follow their own inclinations and curiosity. After finishing such a sequence of instructions, the system displayed a text message: 'Now move on and explore somewhere else'.

1 Ed and Tom walk along a gravel path. They listen to an audio clip (delivered through the PDA speaker to support sharing of the device). It explains how gravel paths enabled 18th Century ladies to walk without getting their long dresses wet. Then a text message appears: 'record a dialogue between two ladies'. Ed reads this aloud, and then tells Tom: "Put on a posh lady voice – we've got to play two ladies". He hits 'record' and says "Hello". Tom responds: "Hello there". Ed says: "Well my servant, he walked in and he did the most terrible thing". Tom asks, "What did he do?" Pretending to be outraged, Ed explains "He fell over the mantelpiece and he knocked over a vase!." They then listen back to their recording.

This is an example of how exposure to a location is orchestrated through a range of system-led interactions, co-designed with teachers. First, the children interacted with the device to retrieve audio clips and instructions, listening and reading. This was followed by role-play, an interaction between the children that promotes imaginative extension of the material. Recording it, they interact with the device productively rather than receptively. The boys include the master-servant relationship in their role-play (an issue referred to during the house tour). In nearly all cases, as here, children replayed their recording.

The following vignette gives an example of how the instructions are designed not just to expose children to information but to encourage them to imagine situations that might inspire their story, and these, again, involve the children in particular forms of interaction:

2 Liz and Becky walk through the Lime Avenue leading to a large lawn which faces Chawton House. Becky, looking at the device, remarks "This is Lime Avenue". She reads the instruction aloud: "Walk towards the house and notice the small window". While walking she reads "Imagine someone looking through one of these windows. Think who it might be: why are they looking out; why are they in this room? Make a brief note of your ideas". Liz (walking) takes her notebook and scribbles. She points to the house: "There's a small window there". Becky repeats "Think who it might be". Liz responds "One of the Knights" and Becky agrees "Yes, maybe one of the Knights".

Here, the children's interaction with the environment in terms of their movement through it, and the direction of their attention, is choreographed by the system. This vignette also connects the house and the grounds, requiring the children to take the perspective of another person (an important element of literacy education). The children integrate previously learned facts (about the Knight family, introduced in the house tour) into the current situation, and, as with Tom and Ed, we see them interacting with each other to develop responses and ideas.

The following two vignettes show how interactions between different pairs of children and the same set of stimuli are not uniform. This is quite different to fieldtrips dedicated to retrieval of factual information to answer preset questions. The vignettes both take place in 'The Wilderness', a small woodland purposely designed to look wild and feel potentially dangerous.

3 Ed and Tom listen to an audio clip "… the ladies of the day would be able to walk through the woodland in relative safety…". Ed sits down and writes in his notebook. The clip continues: "…it was slightly risky, sort of spooky. They were walking and play-acting in The Wilderness." Tom reads from the device: "Now that you know what The Wilderness was used for, spend a few minutes finding a place that a lady in the 18th century would find spooky." Both boys look around. Ed says "Well this, I don't think, 'cause it is kind of nice, like a circle of protection with all the plants". The children move further into the woodland. Tom, holding the device, records: "We have found a place and it is really quiet and shadowy and you can't see anything around you." Ed adds: "And if it was in the 18th century it would be like total silence, must feel quite spooky."

4 Ellen and Maggie, sitting in a clearing in The Wilderness, suggest it was used for "playing hide and seek" and for hunting. Somewhat later, Maggie records: "We think that it is spooky in there in that it is all overgrown, all the branches are twisted and tangled." Ellen continues "Yes, it is rather spooky because it is dark, even though it is really a light summer's day and it's shady." Maggie says, "There was a big hole, which was completely black and it looked like an animal could have crawled in and out, a fox or a snake". They then write down this description in a notebook.

The instructions here encourage the children to observe and become aware of the atmosphere of a location, and they do so in different ways, noticing different things. The children collaborate in hypothesizing and imagining, adding to and building on each other's comments. The following vignette

shows that children do not only imaginatively extend their responses to system prompts, but also search for and integrate factual information beyond those prompts:

5 Ellen and Maggie are instructed by the device to explore the graveyard and to note down names for their stories. Pointing to two headstones next to each other, Ellen says: "There's John Holt. She is his wife – and then, he died before she died. But there's not much – and that's 1895 and that's 1917." After walking around the graveyard they sit down on a bench, take out their notebooks, and note down the information they have collected. Maggie asks "Who died first" and Ellen replies "The husband died first".

At the end of this exploratory stage of the fieldtrip, the children had visited all locations regarded as important by curators, in a fast-paced exploration featuring a range of activities and interactions with each other, the device and the environment. This part of the fieldtrip was effective in engaging children with factual and anecdotal material provided by curators and delivered by the system, as well as prompting them to imaginatively extend this in various ways, to produce a range of data for their creative writing: factual, imaginative, descriptive and reflective. We will later see how this data was integrated into their stories.

Reconvening

After exploring the grounds with the device, the three pairs of children met with the two teachers on the lawn. The teacher asked children which locations they had liked most and to tell each other why. Leila then instructed: "Go back to two locations and there you are gonna start collecting information about your story… And you'll actually be recording things that you might well use in your story – it could be a setting, it could be a bit of action that might happen there, so you need to make your decisions carefully, OK?". She further instructs the children to start thinking about what will happen in their stories, and to use this last chance to "look at the setting and describe it and think about what happens there". Other than this, the teachers were not involved in any of the children's activities.

Focussing on selected locations

The third part of the fieldtrip encouraged children to go beyond the discrete ideas and data collected in the second 'exploratory' part of the fieldtrip, and to start thinking about general issues of character, setting and plot for their stories. Each pair of children focussed on two locations. Whereas in the preceding round of the garden, the children had been moving fast, eager to explore the gardens, and engaging with a whole set of diverse activities, the third part was slower-paced with less variety in activities. The instructions now prompted the children to spend five to ten minutes reflecting, thinking, and writing down their ideas. The prompts did not provide further factual information or new stimuli. The children in each pair could work collaboratively on the same storyline, or work on their own. In practice, the children shared ideas but also spent much time writing in silence. They made extensive use of their notebooks. The girls tended to talk more with each other, sharing ideas for stories. The boys talked less, sharing descriptions of the environment, but fewer ideas for stories.

Instructions at the first location were designed to encourage the children to think about the setting and the main character of the story. One instruction was, for example: 'Imagine your character is in this location for the first time. Now record or write a paragraph from their point of view, describing the setting.' Prompts at the second setting were devised to start the children thinking about events that could happen. The vignettes given here all stem from the second location chosen by the pairs.

6 Liz and Becky sit at the stables. Asked to describe the 'mood' that this area suggests, they describe it as "peaceful, quiet and relaxing". They then brainstorm events that could take place here: "There could be something that goes wrong during a horse race"; "A disappeared horse"; "There could be a fire".

Building on their work on setting and character, all of the pairs started to think of events that they could integrate into their stories to support the plot:

7 Tom and Ed walk through the wilderness, describing the atmosphere. Ed develops ideas about monsters that one might meet here: "Maybe a bear on its hind legs walking, and its in the bushes, so you don't see it and then, you turn, and its right in your face".

8 Ellen and Maggie sit on the bench near the churchyard and read from the device: "Think about how this location links to your other chosen setting. Explain your ideas to your partner." Ellen suggests: "Well it's kind of spooky here in the graveyard. And it sort of is over there". Maggie says: "Yes, but we don't know what is going to happen". Both fall silent for a while, Ellen scribbles something. Then she says "What would happen here? Perhaps something tragic".

These vignettes suggest that the kinds of responses to the environment useful for the story depend on what sort of shape the story is going to take. For all the pairs in the second phase, a form of 'cross-fertilization' appears to be taking place where thinking about the story influences the way the environment is attended to and discussed, and vice versa. This is quite different to working through checklists for facts as per, for example, a geography fieldtrip. Here it is more to do with an emergent imaginative relationship with the environment.

THE STORIES

The following day, at school, the children spent two hours writing their stories in a computer room, supported by their teacher, Leila. At this stage, the children had access to two forms of annotation to inform their storywriting: analogue: the writing in their notebooks; and digital: an electronic log of the fieldtrip, with their audio and text recordings available to be accessed, together with photographs of visited locations. These annotations were made during the fieldtrip in the context of multiple forms of digitally-augmented activity, to produce different kinds of data and ideas. Here we look at how all these threads were brought

together in the children's stories. The key point here is that all the children engaged in a synthesis of factual, historical and anecdotal data grounded in a real setting, with imaginative extension and reinterpretation of this data to serve character, setting and plot. This synthesis involved children in doing new things with storywriting, expanding the range of things that can be written about, and moving beyond their current knowledge. After the session, Leila said the children "normally… stick to things they know… they often write very similarly to the things they read", for example Harry Potter, or their own era and home environment. In orchestrating character, setting and action in ways grounded in a real setting, the children needed to make connections between different data.

Ellen and Maggie wrote stories based on the same initial idea, inspired by the gravestone of a couple where the woman outlived her husband for several decades (see vignette 5). Both stories are a synthesis of character, settings and stories learned at Chawton with existing knowledge and interests around genre. Ellen's story is a story of tragic love between her heroine and a cursed man, mixing elements of cross-class marriage with a ghost story. The heroine is first told by a ghost in the graveyard about the curse on her husband (see vignette 8). In Maggie's story, a character called Martha, after her husbands death, decides to get a maid for company, and meets a young girl, aged 10, in the stable house. She saves her from a cruel master who is whipping her, announcing that 'it's in the Knight family's blood to punish someone'. Martha decides to adopt the maid. This was a theme the children were exposed to during the tour of the house: Sue explained that when the family had no heir, a distant cousin was adopted at age 16. Leila told us that Maggie had asked for advice about correct terminology for the dialogue, an example of making the effort to adjust writing style to a historical period: "She was saying 'Is there a word that they would have said about 'going out together'?'".

During the fieldtrip Becky and Liz, the other pair of girls, settled on the idea of a story around a horse race inspired by the stables, one of the two locations visited in the third part of the fieldtrip (see vignette 6). Both feature a young servant girl living in the stable house running against members of the Knight family in a horse race, who shout at and whip their horses. In Becky's story Edward Knight is an adopted son of Thomas Knight (factually correct). This story features a number of names of real occupants and a sophisticated understanding of their kinship relations. The story also features the concept of inheritance. The adoption theme is not mentioned here but is in Liz's story; neither story makes the link between adoption and inheritance. As with Ellen's story, there is also a strong 'masters and servants' theme.

Different to the pairs of girls, the boys' stories are independent of each other. This was influenced by the amount and type of discussion between the children during the fieldtrip. The girls talked about character, setting and plot while the boys talked less, and mainly about locations. However, both the boys' stories are strongly influenced by the atmospheres they experienced, particularly in The Wilderness, and their imaginative responses. Tom's is a form of thriller with a twist, featuring a boy who finds himself 'lying on the ground filled with sticks', hears a 'rustling noise' that makes him jump to his feet, seeing a 'massive black thing staring right at me' and fleeing from it. Finally the creature trips over, and turns out to be his mother. This story directly relates to some of the boys' fantasies about the spookiness of the wilderness and using it for a chase scene (see vignettes 3 and 7). Ed uses the setting of Chawton House for a 'Narnia'-type story about children finding magic objects around the gardens. Ed uses many locations and includes a lot of details in his story, for example the 18th Century firebuckets in the hallway where one of the magic objects is hidden.

More than one of the stories features material on power and hierarchy relationships. In Ellen's story, 'ladies' like members of the Knight family, have maids. Almost all children present the Knights as 'cruel' to their servants and other living beings (horses), perhaps reflecting opinion on these kinds of relationship. All stories make much use of real names and locations, which children find useful.

The stories produced show a synthesis of factual items from the house, inferences, and imaginative extensions of many kinds. The teachers saw a useful synthesis of historical/location-based research and creative writing and judged the quality of writing positively. Interviewed after the storywriting session, Leila said: "They all grabbed bits of Chawton House yesterday, and they grabbed different things, but they had a ready-made setting there. The things they wrote were different from their normal experiences, so the story-writing for instance in the stables [referring to Ellen and Maggie], and that historical element, isn't something they would normally have written about". We were interested in what the teachers thought about the quality of the writing, and whether this was connected to the fieldtrip. Leila told us that for the able writers this group represents, the fieldtrip obliged them to "think wider than just their story, which is really good"; "I think the quality of what they've written, in terms of… it means they've got a greater range".

DISCUSSION AND REFLECTION

In this research we created a digitally augmented fieldtrip, and applied it to a new area of curriculum: literacy skills. Here we discuss a range of issues: children's engagement with the technology; the mix of analogue and digital technology and activities; the management and use of time; the issue of scaling; teacher supervision; and the use of questions and prompts. Throughout, we consider the value and implications for creative writing and literacy training.

The system was fairly sophisticated, but the children took to it readily. They showed great interest in the devices and had few problems with them. They also showed a sophisticated

understanding of the infrastructure, giving us explanations of how GPS-based location-sensing works. Their level of computer-literacy meant that using digital technology (the devices) came easily, and did not interfere with simultaneous use of analogue technology (their notebooks). This integration of technologies provided a variety of ways to engage with the environment and make recordings. Children switched seamlessly between analogue and digital technologies . However, there is some evidence that each type of technology was used for different purposes. When writing their stories, the children showed interest in the log of their digital annotations, listening to what they had recorded and reminding themselves of locations visited. However it appears that the digital annotations were less important than the process of producing them, which engaged children in memorable engagement with the setting which fed into their work. Notebooks rather than digital annotation seemed to be used for material which the children felt they needed to preserve for later reference.

The design of the fieldtrip mixed analogue with digital in another way: by preceding two digitally augmented tours (of the gardens) with an analogue tour (of the house). In touring the house, the children were supervised by Sue, without the freedom to go where they wanted. Her talk, and the responses she elicited from the children, were effective in giving the children knowledge about the house, particularly the people who lived there. These were used in their stories, and referred to in the subsequent digitally-augmented tour of the garden. The garden tour also asked the children to reflect but in a much wider range of ways, with less supervision. This had effects on the children's engagement with the environment particularly their ability to engage in creative, imaginative and sensory responses as well as factual ones. The digital components of the fieldtrip, whilst engendering particular forms of engagement which the analogue tour did not, also has implications for scaling up beyond six participants (which we felt sufficient for this research given its exploratory, case-based approach). Scaling up an analogue tour simply involves adding more people to the same tour, all of whom get the same experience (if they can hear!). However, the system will work with an arbitrary number of devices, allowing many pairs all of whom can be equally involved; and the physical hypertext model allows information to be structured in different ways. This means there can be many concurrent but different experiences, which could support children of different ability levels or interests.

Leila, the deputy head teacher, made several observations concerning the transformation of fieldtrips via digital means, and the effects on timing and sequencing. She commented: "On a normal fieldtrip… they would be given a worksheet and clipboard; and some children, like the children we had today, would whizz through questions: it becomes a race, who can get things done quicker, you get things like 'I've finished'". She added that the fact that the experience was less predictable in advance, as well as the need to complete a certain task before proceeding to another, "because it was given at regular intervals or fed into them when they were perhaps in certain locations, it paced, it gave pace to the day, instead of the children setting the pace". Both teachers agreed that the use of the technology "slowed them down" and enabled them to focus on the activities. This enabled the children to dwell on tasks without knowing what the next one was. Also, since the system would only provide access to an activity once a previous activity was completed, things 'got done' by children "who wouldn't normally get things done. I think they would do things with the technology, because they know that until they've done something they wouldn't get onto the next bit". However, in the third part of the fieldtrip (focussing on two locations), this 'slowing down' did not appear to be necessary: all the children were sufficiently interested to take time immersed in their thoughts.

The digitally transformed fieldtrip also had implications for teacher involvement and supervision. That the technology paced what the children did, meant that the teachers did not need to. Normally, Leila explained, one teacher would supervise a much larger group and be on hand to provide and answer questions. This was less necessary, and in the process gave children 'freedom' that they commented on and appreciated. Of course, the children were accompanied by two researchers, but it appears we were almost forgotten about: the children talked about 'walking around on your own' or referred to us as 'cameramen'. In addition, although teachers did not physically accompany the children, they facilitated what happened through the prompts and questions that appeared on the devices. Leila said, "the questions that were put together [for use on the portable devices] were very much the sorts of questions I would do verbally, and the things we'd do at the beginning, when we're planning a piece of writing in the school". This shows that creative writing is initially directed by teachers, but not during the process: "we would never do a creative writing worksheet preparation like that".

Questioning and prompting for the purposes of data collection for creative writing is novel for the two teachers: "They're never used to seeing things like that written", said Leila. However, she recognised value here: "it was helping to structure their thinking". The changed formatting of questions and prompts for creative writing were also found valuable by children: "it gave you like inspiration of what to do instead of just sitting there and saying 'this grass is green'"; "It's got really good questions. It gets you to do things that the clipboard wouldn't normally do". The children also enjoyed the freedom: "It let you go wherever you want and then told you what you could do when you were at a certain place". The design of the fieldtrip, enabled by the devices, thus provided a good balance between freedom, creative exploration, and structured activity.

CONCLUSIONS AND FUTURE WORK

In this paper we have presented research to show how UbiComp can be associated with known educational techniques – here fieldtrips – and extended into new areas of curriculum with changes in product and process which are useful and valuable in terms of educational goals, here literacy skills as developed through creative writing.

Learning literacy, according to current UK government guidelines, involves a number of skills. Key amongst these are understanding and being able to construct character, setting and plot. The way this is currently done in schools is through writing and reading mutually informing each other, but, relative to areas like science, geography and history, in isolation from real environments that provide data, ideas and information. We used an ensemble of technology, devices, activities and information to provide multiple forms of engagement with a real environment in order to generate data and ideas for purposes of representation in stories. This was something new for the two teachers, Pam and Leila. No previous fieldtrip had been specifically designed for literacy skills by them, and neither teacher knew of other schools that had done this. As this paper reflects, the literacy fieldtrip was novel, and successful, in a number of ways. The fieldtrip changed both the processes and products of creative writing. Pam said "it's another kind of teaching strategy". When asked if they could see this type of fieldtrip becoming a more familiar part of educational practice, both said "Yes" – given that infrastructure could be set up in relatively confined and monitorable areas. An important issue for teachers is that they are time-pressured. They said they spend 'half a day' on site when preparing a fieldtrip followed by "half hours here and there" at school writing a 'script' for a fieldtrip.

Current work involves short-cutting preparation time by repurposing the system as an authoring tool, allowing teachers (and curators) to walk around a location, building a script by recording data and ideas as they go. Future work includes a more detailed analysis of the data collected, focusing on the interactions of children and reactions to the stimuli provided, as we are aware that here we have presented only a first cut at a larger analysis. We further aim for a second trial in 2006 with a larger group of children and improved infrastructure support.

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