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# The Department of Hidden Stories: Playful Digital Storytelling for Children in a Public Library

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## ABSTRACT

We detail the design of the Department of Hidden Stories (DoHS), a mobile-based game to support playful digital storytelling among primary school children in public libraries. Through a process of iterative design in collaboration with library staff and children's writers we designed DoHS to support the potential for playful storytelling through interactions with books. A deployment of DoHS with two classes of 8 to 10 years olds as part of their regular library visits revealed insights related to how to balance the expectations of a child-at-play and the requirement to further develop their creative reading and writing skills. Based on our experiences we recommend that designers create playful digitally based activities that encourage children to explore libraries and experience new interactions with physical books.

## Author Keywords

Storytelling; play; children's library; augmenting books.

## ACM Classification Keywords

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

## INTRODUCTION

We describe the design and evaluation of Department of Hidden Stories (DoHS), a mobile-based game developed to support 8 to 10 year old children in playful digital storytelling and engagement with books in public libraries (Figure 1). DoHS is the result of a process where designers worked with a team of creative writers, library staff and children to explore how physical books found in public libraries could be linked with digital content. The resulting mobile phone game guided children as they explored the library and wrote fictional stories based upon the content of

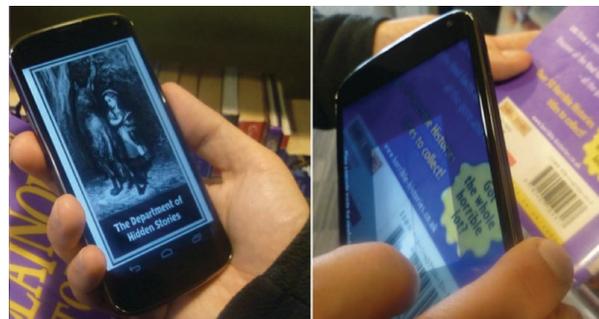


Figure 1. DoHS App – splash screen and barcode scanner

books they found. Their stories were captured on a phone and tagged to each book. By scanning a book's barcode, children visiting the library are able to access stories that were created earlier by others. In doing so, the game was designed to support children in new exploration and browsing activities in libraries, and provide new ways of linking physical books with child-generated digital content.

DoHS was designed in response to claims that modern public libraries are not particularly engaging places for young children to visit and explore books, and fewer children than ever are reading for enjoyment [10, 27]. Nevertheless, libraries are still considered important places for children. The significance of the library as a lifelong learning resource for children is emphasised in the UK through regular school organised library visits between the ages of 5–12 [17]. In response, DoHS was designed to explore how playful digital interactions within the library environment might facilitate children's engagement with their local library in new ways, potentially leading to sustained engagement with literature and libraries.

In developing DoHS, we explore ways in which digital technology can scaffold engagement with the library space and the physical books it houses. Traditionally there has been a disconnection between the provision of ICT and digital technologies in public libraries and the library's core resource of books. The use of digital technologies in relation to books is limited to search systems, providing links to book review sites and self-service loan services that have limited potential in terms of engaging children. Furthermore, DoHS is based upon the idea that playfulness is a core attribute to learning storytelling [1, 25], where

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learning how to tell stories is fundamental to the development of a child's literacy skills [15, 23]. We take a pragmatic focus on the potential benefits such systems may have on learning by suggesting there is value in simply engaging children with libraries and books.

In this paper, we describe in detail the iterative design process that lead to the creation of DoHS through three key stages: i) collaborative design workshops between designers, library staff and creative writers to develop an initial set of simple playful activities and associated rules for children engaging with books in libraries; ii) the piloting of two initial card-based games with twenty 8-10 year old children; and iii) the deployment and evaluation of the digital DoHS game that incorporated insights from the first two stages. Primarily, based on our evaluation of DoHS we contribute a series of insights for the HCI community on how digital technologies can support playful interactions for 8-10 year old children within the space of a library and encourage their engagement with books. Secondly, we carefully consider how our design process and our digital game structures a playful experience to promote creativity.

#### **BACKGROUND: BENJAMIN ROAD LIBRARY**

Our design work is centred on Benjamin Road Library, a state-funded public library located in the inner suburbs of a city in the north of England. It holds a large number of fiction and non-fiction books, DVDs, music, as well as a smaller selection of children's books catering for ages from 3 upwards. Benjamin Road is located in one of the city's poorest and ethnically diverse conurbations, and provides access to a number of core services for local residents. One half of the building is dedicated to services provided by the local social housing provider. Tenants arrive at the entrance to the library, take a ticket from an electronic dispenser, and wait in a large seating area until their number is called out. It is not uncommon for large families to arrive together and wait until it is their time to go to the counter. The bustling noise of people talking to one another and the occasional calling out of "*can number 123 please come to counter 3*" stands in stark contrast with public conceptions of the quiet library space. ICT provision has become important to public libraries over the last decades and this is also true for Benjamin Road. It has 20 PCs which can be booked an hour at a time by members of the public. On many of our visits to the library we observed machines in intensive use. Library staff would also run courses each day using these machines, such as curriculum vitae sessions for the unemployed, or lessons on how to use word processing software for the first time. The library has recently installed a self-service loan kiosk, albeit used rarely, with many preferring to visit the manned desk. The city's libraries had also just released an iPhone app that allowed people to search and request bookings for books and other services.

Our initial insights were formed from a series of visits to Benjamin Road and other community libraries across the city. Two team members also observed and participated in

creative writing sessions organised by schools and libraries for children. Our observations were supplemented with semi-structured interviews with teaching staff who accompanied local school children on library visits and informal meetings with library managers and staff. During initial fieldwork it was clear that the technology provided within most libraries was limited to the use of the bookable desktop PCs. These would be used for a range of activities by library users, from general web browsing and searching for new jobs, to basic word processing. What was notable was the large number of young people (mostly teenagers) observed across libraries using these public computers to access social media (e.g. Facebook) and play free games online (e.g. MiniClip and ebaumsworld). Those visiting the library to use the PCs would rarely visit the book section. Indeed for the most part it appeared that computers were not used to directly engage with books at all. It was clear that in the specific context of Benjamin Road there was a distinct disconnect between the role that technology played and the children's section—the computers used adult seating, they default to adult book services such as book search, and were situated away from the children's library.

It became apparent on initial visits that while play and gaming seemed to be valued in terms of the use of ICT in the library, visits by groups of school children would neglect play as a means of exploring the library. Our meetings with library staff and school staff highlighted how visits to the library would be orientated around finding information from books that relates to specific elements of the national curriculum. Therefore, at an early stage in our engagements with Benjamin Road we considered challenging this view by exploring how play could be introduced into these visits and their associated activities to provide new ways for school children to interact with books, seek information and engage with the library.

#### **Play and Storytelling**

Play as a concept has been well explored by the HCI community [13, 18, 21, 23]. We find Verenikina et al.'s [30] work particularly influential in terms of how theories of play can be applied in games design. They highlight how play is spontaneous, self-initiated and a self-regulated activity where children are actively involved in creating their play and are in control of it. This definition of play shares characteristics with Caillois's *paidic* play (cited [18] and [13]) where play is open, ambiguous and affords self-expression. Cassel and Ryokai [6], Verenikina [30] and others [1, 4, 15] argue that fantasy and make-believe are key elements of play. Fantasy and storytelling can also be seen as core components of telling creative stories, and as such storytelling can also be seen as an inherently playful activity [1, 14]. By playing through storytelling it is also possible to attract children who lack confidence in their reading and writing and help engage the imagination [15].

Storytelling is well represented in the field of HCI and is often supported as a creative activity [4, 8, 11, 16, 22, 29].

We focus here on drawing and building upon work that is synergetic with the qualities of the library site we designed for. A number of systems have explored the design of engaging interfaces to encourage children to form stories and narratives in novel ways. In *Picture This!* [29] augmented toys are used to support children as they direct their own film narrative, while StoryMat [6] allows a child to move freely around an embroidered blanket as they record and recall oral narratives with physical tangibles. Pogo [8] and StoryRoom [22] are aimed at young children (5-6 and 6-8). These systems encourage children to play with tangible objects providing audio and visual cues as to how they should be used. Finally, there are examples of in-situ digital storytelling systems, such as Mobile Stories [12] and TellTable [4], where children explore the immediate environment as part of the creative process. Nevertheless, while TellTable was deployed in a children's library, this space was chosen as appropriate for children targeted by the deployment given it was a lively place, full of toys [4]. TellTable as such did not account for a child's use of the library or engagement with books.

During the Interactive Children's Library Project, Eriksson et al. [10] explored similar challenges to those we face at Benjamin Road. In the design of bibPhone [19] they created a bespoke artefact to allow spoken stories to be added as a new digital layer in the children's library. Eriksson et al. found that children enjoyed using bibPhone to listen to what others had recorded on the books. However, they concede that children were reluctant to make their own recordings. In contrast, StorySurfer [11] encourages children aged 7 and 8 to search for books by using physical play. Here, StorySurfer uses tangible blocks in an installation to get a child to think about the book they want to find. In contrast to bibPhone the emphasis of this study is on play within a bespoke installation, although it is still deployed in the children's library.

This prior work reveals that technology can provide opportunities to support creative play within physical space, as well as support children in searching the specific resources that a library holds. In DoHS we extend this work by not only examining how technology can support browsing and searching for new books, but also in how newly discovered books can support creative writing and storytelling activities.

## DESIGN PROCESS

To begin exploring the potential of linking play and storytelling together in a library-based game, we held an initial exploratory workshop at Benjamin Road. The participants were the project team, which included two computer scientists, two games designers, an interaction designer, two creative writers, an English teacher, a children's book author and a member of library staff. The primary aim of the workshop was to develop a common understanding across the team about the potential for using games to engage children in reading and writing about

books. The majority of the workshop was spent with the team working in three small groups and 'experience prototyping' [3] basic games that were acted out in the library. Each group used blank playing cards to make basic prompts that initiated playful interactions with the library's book collection. After prototyping and iterating their games, the groups reconvened to share ideas. Through further discussion and iteration, three approaches to using prompts were selected to take forward:

*Finding books with specific qualities.* A common approach was prompting players to find a book using simple criteria, such as retrieving a book that used a specific colour. This encouraged exploration of the library through a form of "treasure hunt". The envisioned use here was that child players would be encouraged to seek and touch books, even if this was just reading the cover, flicking through the pages, or reading the blurb on the rear.

*Playing cards with characters, objects and places.* A popular approach was also for games to start by dealing a random character that would be illustrated on a card. This character would take the role of the protagonist. After this, further cards could be dealt that described generic objects and places. These playing cards were inspired by children's trading card games like Pokémon and board games like Cluedo. The purpose of these cards would be to provide the starting elements of a story, from which books would be used to situate the characters, objects and places in.

*Stories with fortunate and unfortunate events.* One group added another set of playing cards that introduced unfortunate or fortunate events to the story. The cards themselves did not describe what the fortunate or unfortunate event was—instead, it was down to the player to find a book to inspire their own story about this change in fortune. For example, a player might start by describing a farmer living by a river. They could be given an 'unfortunate event' card. From browsing the library the child could find a book on volcanoes, inspiring them to write how a terrible fire engulfs the farmer's land. Next they might be dealt a 'fortunate event' card and inspired by a book on firefighting to write how their character uses the water from the river to fight the fire, and so forth. It was considered that these prompts would inspire the child players to collect multiple books in developing a story, winding through a series of changing fortunes. It was taken that this game challenged its player to solve a series of problems for a character through creative writing.

## Card-based Playful Storytelling Games

Following the exploratory workshop, our design processes involved integrating the identified prompts into an initial card-based playful storytelling game. This game was to be piloted with groups of children aged 8 to 10 years on a school visit to Benjamin Road Library.

Reflecting upon the team's own experiences playing the games, it was decided that the pilot should include a short

initial activity that would act as a ‘warm up’ to familiarise the children with the library and the facilitators before beginning the main activity. This game reflected the *finding books with specific qualities* rule, asking children to randomly choose a card from a pack of *object cards*. The game then prompted them to find a related book. The children were told that there was no right and wrong but they would be asked to explain their choice to the other children on their table. This initial exercise would last for 10 to 20 minutes before the children played the main game.

The second game introduced the children to the idea of writing new stories based on inspiration from books. Building on the games developed at the initial workshop, this game included a set of *character cards* and a set of *fortunately and unfortunately cards*. Characters included a doctor, pilot, captain and animals such as a polar bear, which were illustrated on the front of each card. Having a protagonist character was deemed to be particularly important since it can be the persona through which a child exerts themselves into the imaginary world of the game [26]. To focus each child on developing this starting character, we explained how they had become lost from the library and could only be saved by writing them into a new story. The instructions on how to select a character card were left deliberately ambiguous. This meant the children could choose randomly, pick one particular character over another, or even swap their selection with another child.

Once a child had selected a character, they were prompted: “Where does your character’s story begin? Go to the bookshelves and choose a book where your story starts...” The intent here was that the first book they retrieved from the library would help define the ‘qualities’ for the beginning of their story, such as describing a particular place or location. Again, this prompt was intentionally open so as to encourage the child to freely explore their own ideas. Once they had made their selection the children would return to their table to begin writing their story. We covered the tables completely in paper, so the children’s stories could take up as much room as they wanted. We provided a variety of pens and crayons so stories could be created with as much freedom and expression as possible.

Having started writing their story the children would then randomly choose a fortunate or unfortunate event card to continue their story and select another book. The game would continue like this with a succession of fortunate and unfortunate events encouraging the child to return to the library space and come into contact with more books. In order to support different learning styles and relax constraints as much as possible, we did not limit the number of cards children could take, or how much room they could use on the tables. However, the children were warned 10 minutes before the game ended to allow them time to complete their stories. After this the children reviewed all the stories together.



Figure 2. DoHS create mode main screens

### Pilot Study

To test out these initial games we held two workshops at Benjamin Road Library with a total of twenty 8–10 year old school children who represented a wide range of literacy proficiency. The workshops were organised as part of their normal visits that occurred during their English classes. Two teaching assistants accompanied each group, while six members of the research team acted as facilitators. The workshop itself was held in a meeting room in the library, with the discussions on each table audio recorded and the stories documented with photographs. An additional researcher stayed in the library to make observations of the children’s interactions with books and the library space in general. After each workshop the researchers shared their immediate observations and insights before revisiting the game design. This revealed a number of insights regarding how the children engaged with the game that could be taken forward in the design of a digital tool:

*Keeping a physical drawing space:* As children created their stories on paper they used large surface areas and drew boundaries around their work to differentiate it from the stories of others. They creatively used colour, different sizes of text and incorporated drawings into their stories. Digital storytelling systems (e.g. TellTable [4]) often use the convention of a digital canvas to allow drawing, writing and the import of media. It was clear here however that there would be value in using these traditional writing materials as part of the digital game.

*Enabling darker themes:* The use of character cards such as vampires, soldiers, etc. gave children the permissiveness to express stories without fear of being told off. In particular, it provided assurance that they could explore darker themes, which are important in childhood play since it lets children express real life events that may not be positive [23].

*Swapping and sticking with characters:* As we designed our game with collectable games such as Pokémon in mind, we let the children trade their cards. They took delight in swapping their characters with one another as they compared the merits of each card before, typically, returning to their original choice. This made us consider what would happen if the character was not allowed to be swapped, and whether this would impact on engagement.

## DEPARTMENT OF HIDDEN STORIES

We designed DoHS as a two-part game based upon our experiences from the pilot study. The mobile game allowed children to create a digital archive in the library which we held securely online indexed by each book's ISBN number. We designed this archive so it could eventually be scaled beyond Benjamin Road and allow a larger population of children using DoHS at different libraries to discover each other's stories. We also designed the game with specific time-based interactions to provide additional prompts to the child and to carefully control the game's progression in order to stop children skipping tasks. These features would have been difficult to support in a card game, and responded to a number of observations from the pilot study where the children relied heavily on the facilitating researchers to prompt them at certain stages in the game.

In order to create these game features we implemented DoHS as an Android OS app connecting to a remote server. DoHS was developed to be used on any touchscreen Android device. For the purposes of our study, DoHS was installed on Google Nexus 4 mobile phones running the JellyBean operating system. The app presents two interaction modes: *create mode* and *discover mode*. Both interaction modes of the app used a skeuomorph of a book, with pages turned by curling the corner of the touchscreen. We hoped this would allow children to navigate the pages using a simple and appropriate interaction. Children can switch between modes freely, although for the purposes of the study these were treated as separate aspects of the game.

### *Create Mode*

In create mode, children are guided in the creation of stories through step-by-step instructions that are delivered on a set of successive pages (see Figure 2). As per the card-based game, create mode starts by asking the child to help a character, who is lost in the library. This character is chosen randomly from 23 pre-assigned characters in the system. Next, the child is prompted to find and bring back a book from the library where their character's story may begin. At this stage they are asked to start writing and drawing the beginnings of their story using physical materials. Initially, we had envisaged that DoHS would contain a 'virtual canvas' that would allow players to enter text and make drawings either on a hand-held device or on a digital tabletop or surface. However, as noted it was evident from the pilot study that the children valued having a large, physical canvas on which to develop their stories. Therefore, rather than restricting the children to interacting with the small screen of a phone in constructing their story, we focused on supporting the capturing and sharing of these handwritten and drawn stories. Keeping the paper canvas also made the technology more reliable and achievable, which was important given the scalable vision of DoHS.

Once a child feels they have written enough to start their story, they can move on to the next stage of create mode. At this point DoHS asks them to scan the book's barcode and

then capture the start of their story using the phone's camera. The image is associated with the book scanned.

DoHS then changes the fortune that the story should follow. We used the device's accelerometer to allow the child to shake a virtual dice to reveal either a fortunate or unfortunate turn of events. The child is then asked to find a new book to inspire this event and repeat the process of writing, drawing and capturing from the previous stage. This process continues iteratively until the child is given 10 minute advance warning to complete their story.

The game also gauges the activity of the child by looking at the last touch event and movement of the phone, which it detects through the motion sensors. If the phone has not been "used" for three minutes then the game awards the child a random object, which they can either use as inspiration and write into their story or ignore if they wish.

### *Discover Mode*

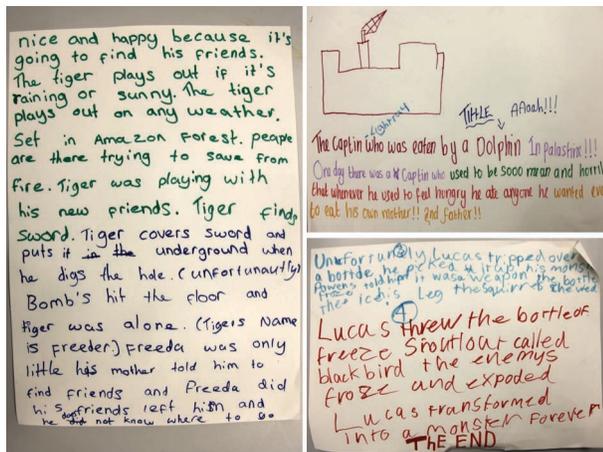
Discover mode allows children to hunt for hidden stories created by other players and hidden in books around the library. DoHS prompts children to scan a book and displays any story segment that has been 'hidden' inside that book. By turning to the previous or next page in the app, the child can see which books other parts of the story are hidden in.

## THE STUDY

DoHS was deployed in Benjamin Road Library in two further workshops with the same 20 children who had participated in the pilot study. As before, the children were accompanied by teaching staff. We used the dictation facility on each mobile phone as a way of documenting audio from the workshop, which enabled us to capture the children's conversations both in the workshop room and in the library space itself. This was supplemented by field notes from each researcher detailing interactions between children, teachers and facilitators as well as the children's use of the library space. DoHS also logged interactions with books for later analysis.

Over the course of the two 2-hour workshops, the twenty children collected 109 books. The books chosen by them to incorporate into their stories were diverse, ranging from non-fiction such as books on the geography of Asia, to fiction such as Alice in Wonderland and Dracula. The relative freedom that we provided for the children to explore the library also meant that there were instances where children picked books from the adult section, much to the bemusement and occasional concern of the teachers. 10 of the 109 books in total were used by both of the workshop groups.

To understand how the experience of creating stories and discovering books unfolded through playing DoHS, an inductive thematic analysis [4] was performed on the research data gathered from the workshop. This involved members of the team repeatedly listening to 20 hours of audio from the workshop and transcribing this data. Initially, the codes drawn from the data included examples



**Figure 3. Various stories. (a) Tiger hides sword (b) Different coloured pens (c) The End**

of emotion such as cruelty, control and humour which reflected details within the children's written stories. Through coder discussions these codes were grouped under the theme of 'self-expression' allowing the team to look at the wider picture of what was happening in the context of the library. In total, we grouped codes into five overarching themes: 1) *Browsing the shelves*, 2) *Incorporating books into stories*, 3) *Structuring stories*, 4) *Following and subverting rules*, and 5) *Self-expression*. These are described in the following section, where our child participants are given pseudonyms, the facilitating researchers labelled 'FT', and teaching assistant or teacher as 'TA'.

### Browsing the Shelves

One goal of create mode was to support the children in exploring the resources of the library without direct facilitation from the research team or teaching staff. The vast majority of the children felt immediately comfortable leaving the confines of the workshop room and exploring the shelves for books within which their character might 'live'. Upon arriving in the library space it was clear that the children had very different approaches for searching for books to begin their character's story.

After establishing their characters a group of boys immediately ran through the library in search for specific types of books that they wanted to support the start of their story (in this case, Dracula for their vampiric character who began life as a doctor). Their interactions with the shelves were short, focused and chaotic—they had a strong sense of what type of book they were looking for and left as soon as they found it. Other children responded more cautiously to these initial explorations around the bookshelves. Chloe struggled to find a book about a tiger, "Miss, I can't find a book with a tiger in." Eventually Chloe is helped by a teacher to find the animal section where she looks for books that might contain tigers. Like the boys before, Chloe had a strong sense of what she wanted to find.

Although some browsing activities during create mode were jovial and vociferous, it was during the discovery mode where the children searched for books in ways that might be considered particularly unfitting of traditional library etiquette. To ensure as little disruption was caused to the library as possible, rather than return the books children used in their stories to the shelves we formed a temporary library shelf in the room where the workshop was held. At the end of the workshop the children were prompted to use discovery mode to explore these books and find where stories were hidden. This part of the workshop caused the most excitement and there were cries from the children, such as "whoah! Whoah!" in response to finding a story. In this activity we saw children browse the books randomly after an initial enthusiastic charge toward the shelves, as they dashed to get hold of anything that took their fancy. In one case the children discovered "Phenomenology of Perception". This book revealed some captures of the workshop room and the book itself, which had been brought to test barcodes after setting up the phones. This book caused real excitement as children realised they had found something secret and had got the better of the adults.

### Incorporating Books into Stories

Along with diversity in browsing behaviour, there were also a number of critical differences in how children incorporated found material resources into their stories. Some children were inspired by imagery on covers or inside the book, while others used only the title of the book, or were inspired by the names of the book's characters. For example, Amber received the Tiger character, which she immediately named Freeda. Amber started by browsing for a book that would allow her to start adding details to Freeda's character. She was very deliberate in identifying a book, and although the nearby teachers made several suggestions she avoided taking their advice and picked up a non-fiction book on Asia: "They will show me how to colour in a tiger." On returning to the table, Amber continued to develop Freeda which led to a conversation with a researcher who mistakenly suggested that a tiger should be fierce and eat zebras. Amber was appalled by this idea and told the researcher decidedly that: "They don't eat zebras". Amber was then happy to continue her story setting the scene that described a friendly and social tiger; Amber writes that the tiger "was nice and happy because it's going to find his friends. The tiger plays out if it raining or sunny." Later, after starting with this positive scene Amber received an unfortunate event. Reflecting on the pictures of lone Tiger's in the Asia book, she asks for confirmation from a nearby researcher: "Something about being lonely. [...] I'm wondering if the tiger can have a friend that can maybe run away." When she returns from browsing, she has found a book titled "Slavery: from Africa to the Americas." When asked why she had picked this booked, she explained: "if you were a slave, you would be very lonely."

Amber's example illustrated how some children responded to the some of the immediate qualities of the books or the rich imagery discovered inside. Others borrowed ideas from the actual text after reading some content. Harry was writing a super-natural story about an evil doctor surrounded by his evil minions. On returning from a browsing trip Harry had found a book about a black hole and explains to a researcher why he chose this book:

Harry: *In a black hole. A doctor went to see to it. Then some creatures from the black hole entered. If they come near you, you can get a rash.*

FT: *Why did you choose this book?*

Harry: *Because I don't know about black holes, so I picked up a book about black holes and read the blurb, and it's full of good ideas.*

### Structuring Stories

Although the create mode provided specific prompts and activities for children to undertake in writing their stories, the ways in which the stories themselves could be structured were still left ambiguous as per our pilot game. We observed that children started to form their own ways of creating a narrative and structuring their stories. Watt's story structure [32] describes eight key story points such as 1) Stasis 2) Trigger, 3) The quest, 4) Surprise, 5) Critical choice, 6) Climax, 7) Reversal and 8) Resolution. In the children's stories we can find examples of many of these key points, for example, Chloe's story about a fierce tiger called Terry begins with an explanation of the stasis, or status quo: *"It all started with fright. In India there was a tiger called terry, was a fierce one. He was king of the jungle. He was a good hunter."* The stasis in the children's stories in our study is often followed by a trigger that sparks off the story. In Chloe's story, the trigger is the tiger whose bad fortune is compounded by heavy rain: *"But one day wasn't in shape, he was feeling awful"*, and *"Suddenly it was raining so much"*. In Jim's story there are examples of climax: *"The next week it was the day, the big day, it was world war 6"*. Following this, his story ends with some finality: *"Dan daan daaan! It is Kevin the solider! He got £50 million pounds and he was The King!!!"*.

### Following and Subverting the Rules

As noted, the level of independence afforded by the create mode differed from child to child. Although none of the children appeared to struggle to act independently in creating their stories at one stage or another, it was clear that many were concerned about following the 'rules' of the game. Some were unsure of what the 'right' or 'wrong' way of starting their story would be, despite assurances from the researchers that there was no right or wrong. Some of the children felt being free to write anything was a misunderstanding, or an elaborate trick being played by their teachers and the researchers. They needed to know they were doing the "right" thing, that their story's direction and meaning was ok and made sense. They also needed assurance that the books were the right choice for the

prompts they had received, for example James asked, *"Miss, I need to look for another book for fortunately again. It could be like... I could get the ghosts out of the house?"* Indeed, on some occasions the children's concerns about playing the game correctly were affirmed further by the intervening TA's who would question their stories and unwittingly undermine children's narrative decisions.

We also observed instances of how children upheld the game rules. Amber was so engrossed in writing her story that the game assumed that she was stuck since the phone had not been touched or moved for three minutes. The game presented Amber a new random object, in the hope it would help inspire her story. This object card happened to be a picture of a sword. At this point Amber sighed and dismissed the prompt on the phone. She exclaimed to the nearest researcher that Freeda was friendly and the tiger could not possibly be interested in the sword that had just been given to her. Amber's solution was to let her tiger decisively dispose of this unwanted object card (top-left in Figure 3a). She wrote: *"Tiger was playing with his new friends. Tiger finds sword. Tiger covers sword and puts it underground when he digs the hole."* Amber then returned to telling the story as if the event had not happened. This is notable because Amber could have ignored the object completely and pretended it hadn't happened, but instead she subverted the story itself to deal with this intrusion.

Although most of the children followed and seemed to enforce stricter rules on themselves than the game implied, there were also examples of where the 'rules' of the game were subverted. Unlike the card-based games, one rule here was that the child would have to use the randomly assigned character given at the start of the game. Some of the children had learned through self-exploration however that closing DoHS and restarting it would mean receiving a different character at the start of the game. On initial observation, it appeared that those children who restarted the app did so because they disliked their initial character:

Jack: *I'm changing mine!*

FT: *Are you trying to secretly change it by going back?*

Jack: *Yeah*

Jim: *I don't wanna be a nurse!*

After this exchange they continued restarting the game until both had the soldier character. The boys 'cheating' was not just because of their dislike for the nurse character as indicated. They were also seeking to write their stories together with the same characters—in this case a soldier, which they had learned from other children was one of the characters available in the game. In another example Andy wanted an unfortunate card instead of the fortunate card that they had been given. They were caught closing and restarting DoHS by a researcher, leading Andy to exclaim: *"We weren't cheating...!"*

## Self-Expression

Finally, DoHS supported the children in expressing themselves creatively through their interactions with their peers and the stories they created. Some would express themselves simply by giggling or laughing while writing their story. In one example, Emily described how she was getting married in her own story, as she declared while giggling: *“I want a wedding book as I’m getting married to Justin Bieber!”*. Quite often humour was driven by unfortunate events occurring to the characters within the stories. On many occasions we witnessed stories being created where the characters would be punished in unlikely situations. The children would frequently express their humour at these stories through expressive language and theatrical laughter such as: *“hahahah. [...] the pilot broke his back so he’s in hospital!”*

The children also expressed themselves through the ways in which they constructed their stories with the crayons and paper made available to them. As with the pilot workshop, the children quickly felt comfortable working on paper and as before used different crayons to represent aspects of their story. Three girls in one session all preferred to draw what their characters looked like to begin with when starting their stories. Others drew illustrations and added visual details to their stories as they were being created. Sometimes these appeared to be as a distraction from the game—often however it seemed out of self-directed enjoyment. One girl however became deeply frustrated, exclaiming: *“ah it’s rubbish!”* and *“I can’t draw at all”*. While most enjoyed writing in this way, it could be a frustrating process for those who felt less comfortable with their writing or drawing skills.

Self-expression also emerged through visceral acts of frustration when playing the game. Sometimes this frustration was born of programming bugs (such as DoHS not connecting to Wi-Fi correctly) or problems with scanning books because of damaged barcodes. The deepest frustrations however related to the prompts provided by the game. As we noted above, some children ‘gamed’ DoHS by finding ways to generate new characters if they disliked the initial selection the game provided. Lily however did not enjoy her selection (a ‘captain’) but was not aware of this ‘trick’. She persevered with this character but stated on a number of times that she *“didn’t like him”* and *“there’s nothing I can do with him”*. Great frustration was also felt by those who were dealt the same event cards several times on a row. While frustrating, this led to huge cries of excitement when finally receiving the opposing card.

## DISCUSSION

In designing DoHS we aimed to create a digital game that supported new modes of exploring and interacting with the core resources of the public library: its books. Rather than take an approach that prescribed children which books they should interact with, we looked at carefully prompting children to discover new or unusual books that could

inspire them to create their own stories. These same books were then to be used as a resource to discover the stories participating children had created.

The British public library has traditionally not been a very playful space. This is highlighted in the ways in which digital technologies have typically been used here—to organise information, to act as digital archives, and to provide more efficient ways of locating books. Yet the act of reading, writing and being inspired by books can be an inherently creative and playful act [15]. This is particularly important to young children who lack confidence in their reading and writing skills. Although DoHS was oriented towards general engagement with books and not educational outcomes, our findings suggest that playful digital storytelling can support both curricular and extra-curricular interactions with books. We reflect on these findings in the following, noting implications for the design of future playful technologies in this context.

### Starting stories with characters or prompts

As noted, the children browsed and searched for books in very diverse ways. It is clear that our decision to initiate their stories by responding to a randomly assigned character hugely influenced the beginnings of the story and the manner in which each child searched for their first books. As we saw in our themes, some children were very direct in how they searched for books to inspire their character. They would go straight to the appropriate section in the library, i.e. reference books or maps, looking for a specific book or browse books holding onto an idea of what they were looking for. The game provided the assurance the child needed by providing characters that they had preconceived ideas about. This selection of the character (even though it could be random) preloaded their tale as it made their writing prescriptive by effectively limiting their amount of free-expression. In some cases this led to children subverting the game (by restarting the app) as they sought new creative ways of getting around this prescriptiveness. We suggest that this subverting of the game was positive. It was a display of imagination and inherently not risk free; children did not know the repercussion to the game or what would happen if they were caught.

Rather than provide a complete character, our design could have borrowed a convention from games - a character builder. A character builder typically defines the character from a much smaller granularity. This may be a series of questions asking the child whether their character was mythical, real, what age they were, or if their character was an animal and so on. This would give the child more control in not only their character’s development but also their story and place them in control of the play from the onset.

### Letting the child take control of the structure

Related to the prior point, DoHS also heavily influenced the ways in which children constructed their stories over time in the provision of the fortunate and unfortunate events. The aim of providing these prompts was to leave a child to

respond openly to what could be considered ‘fortunate’ or ‘unfortunate’. Yet we saw occasions where children struggled to find inspiration for these events from books. This led to the teachers and researchers having to help.

One response to these issues might be to expand upon the range of prompts. We saw how some children’s stories followed a story arc, and a set of prompts around these features may be one way to initiate more flexible and diverse responses from children. This could be taken further and provide a child with a set of arc elements to choose from, asking them questions such as: ‘your character is surprised, tell us why’; ‘a big event will happen in the future, what is it?’ From here a child might build their story up in a still creative but more controlled manner.

### **Providing expressive places to play**

A decision taken early on was to allow the children to use the tables covered in paper as the ‘canvas’ on which to construct their stories. This design decision was carried through to DoHS. As we saw, the children enjoyed making use of this large space and developed their own ways of expressing their stories within their own, unbounded, space. Having this space external to the phone also supported multiple interactions at once—it allowed a child to have their phone with its situated prompts, the book acting as inspiration and the space on which to construct the story laid out in front of them at once. As such, rather than being the centre of play, DoHS was scaffolding and supporting play in this existing physical environment.

Providing this large expressive space however did raise problems for the children, and in the latter workshop impacted negatively on the experience of DoHS. What was especially challenging was the disconnection between DoHS and the written material. In DoHS sharing a story was based upon photographing each phase of the story as it was being created and tagging this to a book. However, the children regularly had practical difficulties in using the phone’s camera. They also struggled to get a sense of what part of their story to capture each time: should they capture just the last bit they wrote, or the entire story? Invariably they chose to capture it all each time, meaning their images became gradually harder to read on the devices display.

There are likely far better ways of capturing the written and drawn data the children created than as executed in DoHS. Prior work has explored the use of Anoto pens [31] or the Wacom Inkling [7] to translate handwritten into digital content. However, in practice these devices require further equipment and come with additional technical challenges. Furthermore, they would restrict the real estate of the canvas, which the children most appreciated. Instead, we might consider ways of providing new prompts in games like DoHS where the expressivity of photography for children [9] is harnessed further. We might imagine additional elements of the app that support the child in constructing their documentation of the story in creative and expressive ways—such as only revealing one part of

their story, or providing hints to someone who discovered their story as to where the next part of their story may lie.

### **CONCLUSION**

As with any study, there are limitations to our findings. While the children who participated in our workshops were diverse in ethnicity and literacy level, we were still limited to meeting the one class as two separate groups. This includes involving the same children in the pilot workshop and the digital DoHS workshop. Clearly this may have biased some of the responses from the children, who were indeed highly motivated to play DoHS after playing the pilot game. However, as our intention was to support an iterative design process and not a comparative study, involving these same children engendered a sense of ownership over the design of DoHS, and supported them in being able to comment on what was better (or worse) about DoHS in comparison to the initial card game.

While we do not seek to over generalise in our findings, our initial evaluation of DoHS is promising in terms of strategies for the design of new library spaces and services. Libraries and similarly schools are often considered institutions bounded by rules. Meyers [20], for instance, describes how preteens perceive the library as somewhere they are told to be “SHHH!”, and that “*Libraries are so-o-o quiet—they are creepy*”. These public perceptions impact on who uses the library and indeed how it is used [28]. Regardless of the library stating users no longer need to be quiet, this perception still widely exists, and as a result libraries remain quiet spaces. Some of the most compelling observations of children using DoHS relate to how they ardently ignored adults’ suggestions for potential books and storylines. Additionally, while playing along with DoHS they found ways to usurp its rules of play and structure. By creating a simple game based on playful principles where children are put in charge of their own self-initiated, spontaneous and self-controlled play [30], we simultaneously created a context where children felt free to break a number of the institutional rules (both school and library) around them: no use of adult book sections, no running in the library, no shouting. Our library partners also remarked on how the children appeared to use the library space in ways that are not afforded by normal school visits, and have noted an increase in recurrent visits from our participants. We are continuing to develop DoHS across other libraries, employing playful design principles in the design of the library space to help people of all ages appropriate these spaces for lifelong learning that better suits a multitude of potential users. Rather than designing tools that are a focal point of play, we argue that we should design tools that act as conduits and mediators for play. In DoHS, we have illustrated how we can design playful interventions to promote such activities from an early age.

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## REFERENCES

1. Åkerman, P. and Puikkonen, A. Prochinima: using pico projector to tell situated stories. *Proc. MobileHCI '11*, ACM (2011), 337-346.
2. Arrasvuori, J., Korhonen, H. and Väänänen-Vainio-Mattila, K. Exploring playfulness in user experience of personal mobile products. *Proc. OZCHI '10*, ACM (2010), s88-95.
3. Buchenau, M. and Suri, J. Experience prototyping. *Proc. DIS '00*, ACM (2000), 424-433.
4. Braun, V. and Clarke, V., Using thematic analysis in psychology. *Journal of Qualitative Research in Psychology*, 3, (2006), 77-101.
5. Cao, X., Lindley, S., Helmes, J. and Sellen, A. Telling the whole story: anticipation, inspiration and reputation in a field deployment of TellTable. *Proc. CSCW '10*, ACM (2010), 251-260.
6. Cassell, J. and Ryokai, K. Making Space for Voice: Technologies to Support Children's Fantasy and Storytelling. *Pers. Ubiqu. Computing*, 5 (3), 169-190.
7. Chiang, C., et al. Birds on paper: an alternative interface to compose music by utilizing sketch drawing and mobile device. *Proc. TEI '12*, ACM (2012), 201-204.
8. Decortis, F. and Rizzo, A. New Active Tools for Supporting Narrative Structures. *Personal & Ubiquitous Comput.* 6, 5-6 (2002), 416-429.
9. Durrant, A., Hook, J., McNaney, R., et al. Design to support interpersonal communication in the special educational needs classroom. *Proc. IDC '13*, ACM (2013), 46-55.
10. Eriksson, E., et al. Inquiry into libraries - a design approach to children's interactive library. *Proc. Design Inquiries* (2007).
11. Eriksson, E. and Lykke-Olesen, A. StorySurfer: a playful book browsing installation for children's libraries. *Proc. IDC '07*, ACM (2007), 57-64.
12. Fails, J., Druin, A. and Guha, M. Mobile Collaboration: Collaboratively Reading and Creating Children's Stories on Mobile Devices. *Proc. IDC '10*, ACM (2010), 20-29.
13. Gaver, B. Designing for Homo Ludens, Still. In: *(Re)searching the Digital Bauhaus*. Binder, T., et al. (eds.). London, Springer, 163-178
14. Garzotto, F. and Forfori, M. Hyperstories and social interaction in 2D and 3D edutainment spaces for children. *Proc. HYPERTEXT '06*, ACM (2006), 57-68.
15. Göttel, T. Reviewing children's collaboration practices in storytelling environments. *Proc. IDC '11*, ACM (2011), 153-156.
16. Hourcade, J., et al. KidPad: collaborative storytelling for children. *Proc. CHI EA '02*, ACM (2002), 500-501.
17. IFLA, *Guidelines for Children's Libraries Services*, IFLA, Edinburgh, 2003.
18. Lindley, E., S, Harper, R., and Sellen, A., Designing a technological playground: a field study of the emergence of play in household messaging. *Proc. CHI '10*. ACM (2010), P. 2351-2360.
19. Lykke-Olesen, A. and Nielsen, J. bibPhone: adding sound to the children's library. *Proc. IDC '07*, ACM (2007), 145-148.
20. Meyers, E. The Coolness Factor: Ten Libraries Listen to Youth. *The Journal of American Libraries* 30, 10 (1999), 42-45.
21. Monk, A., Hassenzahl, M., Blythe, M. and Reed, D. Funology: designing enjoyment. *Interactions*, (September 2002), 11-11.
22. Montemayor, J., et al. Tools for children to create physical interactive storyrooms. *The Journal of Comput. Entertain.* 2, 1 (2004), 12-12.
23. National Literacy Trust. *Literacy Guide for Secondary Schools 2012-2013*. National Literary Trust, London, 2012.
24. Pykhtina, O., Balaam, M., Wood, G., Pattison, S., Kharrufa, A. and Olivier, P. Magic land: the design and evaluation of an interactive tabletop supporting therapeutic play with children. *Proc. DIS '12*, ACM (2012), 136-145.
25. Ryokai, K. and Cassell, J. Computer support for children's collaborative fantasy play and storytelling. *Proc. CSCL '99*, International Society of the Learning Sciences (1999).
26. Salen, K. and Zimmerman, E. *Rules of play: Game design fundamentals*. Cambridge, MIT Press, 2003.
27. The Reading Agency. <http://readingagency.org.uk/news/reading-facts003/>
28. Usherwood, B. and Linley, R. New Library - New Measures: A Social Audit of Public Libraries. *The Journal of IFLA*, 25, (2), 90-96.
29. Vaucelle, C. and Ishii, H. Picture this! Film assembly using toy gestures. *Proc. UbiComp '08*, ACM (2008), 350-359.
30. Verenikina, I., et al. Child's play: computer games, theories of play and children's development. *Proc. CRPIT '03*, ACS, (2003), 99-106.
31. Vines, J., Blythe, M., Dunphy, P., Vlachokyriakos, V., Teece, I., Monk, A. and Olivier, P. Cheque mates: participatory design of digital payments with eighty somethings. *Proc. CHI '12*, ACM (2012), 1189-1198.
32. Watts, N. *Write a Novel and Get It Published: A Teach Yourself Guide*. London, Teach Yourself, 2010.