Supporting Children's Collaborative Authoring: Practicing Written Literacy While Composing Oral Texts

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> *But it is in the process of composition – in 'wrestling with words and meaning' – whether to render subtleties of feeling, to convey precise observation of objects, or to develop a coherent line of reasoning, that one ultimately becomes most fully aware of the power – and limitations – of the written language.*
> *(Wells, 1981)*

ABSTRACT

This paper presents the theory, design and evaluation of a new type of computer-supported collaborative interface intended to help young children practice certain oral language skills critical for later written literacy acquisition. Based on a theory of "emergent literacy", this paper describes a toy – TellTale – designed to let young children create, share and edit oral language in a way similar to how they will eventually create written language. One user study was conducted with children of different socio-economic strata. Their use of TellTale suggested that children of different SES seem to use different social and linguistic strategies to establish cohesion and that purely syntactic measures of narrative coherence are not sensitive enough to reveal all aspects of children's collaborative language construction. A second pilot study investigated how groups of children used TellTale during oral language play; while the results are not conclusive, they seem to suggest that TellTale is an engaging interface for group authorship.

Keywords
Emergent literacy, collaboration, authoring, language, play, toys, socio-economic strata.

INTRODUCTION

Old distinctions between collaborative learning, group play and language instruction are changing as both digital media and our relationship with technology evolve. By carefully designing technology-enhanced language toys that give children control over both the structure and content of their language, young children may be able to engage in literacy activities previously thought to be too advanced for their age.

This research addresses a particular aspect of this new opportunity. Specifically, it claims that a tangible technology-enhanced to that supports collaborative construction of oral language can help children practice certain skills crucial for later written composition. A particular language toy – TellTale – was developed to investigate this claim.

THEORETICAL MOTIVATION: EMERGENT LITERACY AND PLAY

Traditional Views of Literacy
Most traditional definitions of literacy acquisition only consider how children learn to create and understand text. For example, Olson (1977) claims that literacy is closely coupled with text, arguing strongly that "the ability to decontextualize language results from the manipulation of written media." Hicks (1990) states that conservative definitions of literacy label someone literate if he or she can "comprehend and produce written media." Traditional views have also considered literacy acquisition to be a process that requires active teaching: "written language has been assumed to be a process that is learned through instruction, that written language instruction lets children transfer linguistic knowledge to a visual rather than auditory modality" Pontecorvo and Orsolini (1996).

But what about children who cannot yet read or write or who are simply not interested in traditional literacy activities? Are they also capable of composing language? And is it possible to acquire certain literacy skills through interaction with media other than text?

Wells (1981) makes the fundamental assertion is that literacy is actually the ability to create external communication – or "make meaning" – across space and time. When language is instantiated in external artifacts, it begins to have permanence. It can be use for reflection, memory and sharing meaning with others currently not present. Children's use of literate language occurs, in a sense, the first time *meaning* is separated from *context*. In this way, language becomes "decontextualized."

If literacy is about making external meanings and creating decontextualized language, then we artificially limit ourselves by considering only the written medium. In a sense, if we decouple literacy acquisition from reading and writing, we can broaden the kinds of tools and collaborative activities designed to support group authorship and language learning.

Emergent Literacy and the Oral-Written Continuum

There is now general agreement among researchers that children know much about reading and writing long before they become conventional readers and writers (Sulzby, 1996; Whitehurst and Lonigan, 1998; Pontecorvo and Orsolini, 1996; Kies *et al*, 1993; Garton and Pratt, 1989; Pontecorvo and Zucchermaglio, 1990). This alternate view of literacy is called "emergent literacy." However, there is little agreement on exactly how the features of oral and written emergent literacy skills overlap and how they are related to later, conventional literacy skills.

Whitehurst and Lonigan (1998) offer perhaps the most inclusive definition of emergent literacy: "it is the skills, knowledge and attitudes that are presumed to be developmental precursors to reading and writing and the environments that support those developments." Emergent literacy acquisition is thus seen as a cognitive *and* social phenomenon.

Sulzby (1996) argues that emergent literacy acquisition is not restricted to interaction with text. She has observed that young children often "speak written language" and "write oral language" and suggests that emergent literacy development occurs along an "oral-written continuum." Sulzby also observed that, when talking in formal monologues, some children engage in "book-talking" (oral language with few disfluencies, a neutral tone and a formal structure that resembles organized text) and cites this as evidence that children acquire emergent literacy skills through the combined influence of oral and written media.

Other researchers agree finding that: children use common strategies during oral expression of written language (Pontecorvo & Orsolini, 1996); children's ability to construct a two-sided dialogue is a precursor to written text construction (Hidi & Klaiman, 1984); using oral language as the basis for written text provides important "self-cues" (Bereiter & Scardamalia, 1982); and that spoken narratives produced by children familiar with a literate style or more likely to use specific writing-like syntactic devices (Michaels and Collins, 1984)

In short, children do not learn to read and write spontaneously and in isolated and overtly pedagogical contexts where text is primary. They instead gradually learn to create and comprehend written language while they are still deeply immersed in social and collaborative contexts in which oral language is the primary means of communication.

But while there is a great deal of literature suggesting that children seem to be using a common set of cognitive strategies during oral and written language use, there is little evidence for exactly how young children's oral language can be supported in ways that will help them acquire written literacy skills in the future.

Language Play as an Opportunity for Literacy

Play is one of the first opportunities children have to "make external meaning." They begin to experiment with relationships between their real, physical world and their constructed, fantasy world (Bruner, 1986). Using language, children learn to negotiate and define this relationship (Vygotsky, 1962; Sutton-Smith, 1997; Garvey, 1990). Play is the one time when children are not just allowed to take creative risks – good play *requires* it.

Play is also the time during which much fantasy and collaborative storytelling spontaneously occurs. By using language during play to describe other worlds, events and characters, children begin to experiment with what successful "decontextualized" language is, how to assume multiple perspectives and how to resolve the conflict between what was *meant*, what was *said* and what was *understood* (Vygotsky, 1962; Pontecorvo & Zucchermaglio, 1990).

And collaborative language play already naturally happens. Garvey (1990) found that children engaged in focused interaction or mutual engagement during play an average of 66% of the session and Preece (1992) found that children's spontaneous stories involved collaborative telling approximately 70% of the time.

TELLTALE: A TECHNOLOGY TOY TO SUPPORT COLLABORATIVE COMPOSITION DURING PLAY

TellTale is a new toy designed to support children's language development. It is a collaborative interface intended to give young children control over both the structure and content of their "externalized meanings" in an audio-recording device that supports text-like authorship. Four principles were identified that were intended to ground TellTale's development in developmental linguistic theory and guide its interface design:

> **Voice:** children create all the content; there is no pre-scripted language.

> **Structure:** children organize their own language and determine the type of language (*e.g.* sounds, words, sentences, dialogue, *etc.*) that best suits their goals.

> **Reference:** children make reference to language segments through a variety of interface properties (*e.g.* color, position in a sequence, proximity to other segment, *etc.*).

> **Reflection-Revision:** children can – individually or as a group – share, discuss and edit both the structure and content of language.

It is important to note that, as much as possible, these guidelines were designed to be child-controlled and media-independent. They are intended to support a composition process that can be completed without adult guidance and that can applied to everything from audio to text to picture to movie creation.

The TellTale Interface

TellTale is a caterpillar-like toy with five modular, colored body pieces and a head. Children can press a button on each of the five body pieces to record 20 seconds of audio into that body piece. The child can then play back that audio by pressing the body piece's record button.

The body pieces detach from each another and can be arranged and rearranged in any order. At any point the child can attach the toy's head to the body in order to hear the entire story (*i.e.* the audio recorded into each of the five pieces) played in sequence. The child can also record over the audio in any body piece at any time. All body pieces are identical in functionality.

Figure 1: TellTale
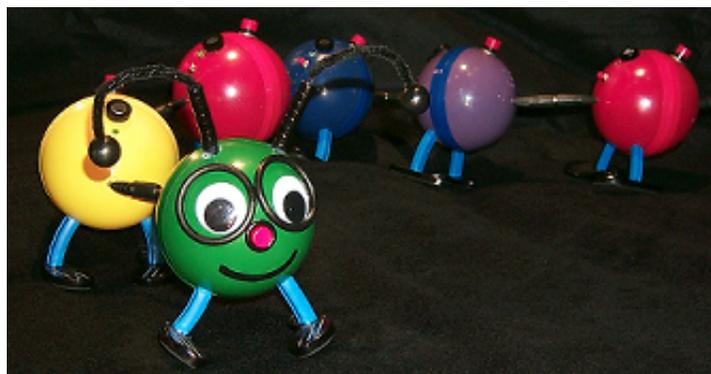
Because each body piece only contains 20 seconds of audio, children are encouraged to reflect on the surface structure or words they use to tell their story. And because the body pieces can be reorganized, children are encouraged to reflect on the coherence among story segments. Since each body piece can be re-recorded, children are encouraged to reflect upon the role of each story unit in their narrative.

The segmented but interconnected interface was designed to support many different types of individual and collaborative play. For example, one child can create a single story using all body pieces; two children can divide up the body pieces to record a single story (or two individual stories); in a group of children, each child take responsibility for a single body piece, either as an independent segment or a part of a larger story.

The colored pieces are also intended to make reference easier. Children can refer to story segments by pointing at a body piece and describing it by color (*e.g.* "the red one has the ending in it") or by position (*e.g.* "the beginning goes

in the first piece"). Such reference is usually not possible with conversational dialogue or with audio represented in generic, non-segmented artifacts (*e.g.* a tape recorder). TellTale is designed to help children make reference to individual or collected segments of language similar to how they will eventually work with written text.

Technical Implementation

Each TellTale body piece contains a digital audio recording and play-back circuit board, a speaker, a microphone, a play button and a record button. Each body piece also contains forward and rear connectors that enable electronic communication between two adjacent body pieces.

To avoid re-engineering stable playback and recording hardware, an off-the-shelf circuit board was incorporated into the custom-built body pieces. To enable communication between body pieces, a simply circuit was designed that takes advantaged of a feature of the circuit board. After each body piece finishes playing, a +5V signal causes an LED to light. Since this signal indicates that a given body piece's audio had finished, it is the perfect signal to use to tell the next body piece to play.

Figures 2 and 3: Playing and Connecting TellTale

After users play a body piece, the +5V signal is sent to the LED. If there is another body piece attached to that one, +5V is sent through a standard mono audio cable to the next body piece. This signal is then used to start playing this next body piece and audio cascades down the entire caterpillar.

ONE RELATED SYSTEM

There are several related systems that encourage children to tell stories in play settings (*e.g.* Benford et al., 2000; Cassell et al., 2000; Druin et al., 1999; Ryokai and Cassell, 1999) but, unfortunately, a complete review of these systems is beyond the scope of this paper.

It is, however, worth discussing one traditional technology – the tape recorder – in some detail as it seems to have functionality quite similar to TellTale's. Although a tape recorder lets children author content in their own voice, the interface does not explicitly encourage them to experiment with the structure or organization of language. When using a tape recorder, a child's story is one continuous piece of audio and the story's physical representation has no relation to the narrative's structure.

Tape recorders are also sometimes used to introduce children to written text by having a parent or teacher transcribe a child's audio story. Wells (1981) suggests that children should "'write aloud' their stories, notice observations and so on, which the teacher can either take down on the spot or recover from a recorded tape later in the day." This process assumes that teachers have the time and attention required to transcribe long segments of audio.

It is also questionable whether having an adult transcribe audio encourages children to consider how linguistic meaning is differentially represented in oral versus text media and how to establish coherence among language segments. For example, an adult may interpret a child's meaning, repair pauses and disfluencies, insert appropriate punctuation, *etc.*. If the composition process is split between two media *and* two individuals, the child no longer has complete control over the structure and content of the story's final form.

EVALUATING TELLTALE

An earlier study (Ananny and Cassell, 2001) suggested that TellTale's segmented interface successfully encourages children to create cohesive narratives and that children use TellTale's body pieces act as "linguistic containers." Specifically, children seemed to use TellTale's segmented interface to construct stories that were longer and more cohesive (containing more conjunctive phrases and other connectives) than stories told with a non-segmented

interface. Furthermore, these coherence techniques (both verbal and non-verbal) seemed to occur at body piece boundaries, suggesting that the interface's structure helped children organize their stories.

While this study confirmed that TellTale elicits natural stories and that the interface is an engaging tool, it focused on an individual's use of TellTale. The two studies described here were designed to investigate how children use TellTale during collaborative language play.

USER STUDY #1: TELLTALE AND PAIRED AUTHORSHIP

The primary goal of this study was to investigate the specific kinds of collaborative techniques children use to establish coherence within a jointly-authored TellTale story.

A secondary goal of this study was to investigate how TellTale may support the language play of children from different socio-economic strata (SES). Specifically, this evaluation investigated whether children of high- versus low-SES use different strategies to establish narrative cohesion.

Method and Data Analysis

In late November and early December 2000, a study was conducted in Dublin, Ireland to investigate this issue. A total of 22 children participated: 5 low-SES dyads (10 children) and 6 high-SES dyads (12 children). Of the 22 children, 8 were girls (4 girls in the low-SES condition; 4 girls in the high-SES condition) and 14 were boys (6 boys in the low-SES condition; 8 boys in the high-SES condition).

The sessions with low-SES children were conducted at an inner-city Dublin school identified as "disadvantaged" by the Ministry of Education. The sessions with high-SES children were conducted at a suburban Dublin school identified as "advantaged" by the Irish Ministry of Education. All children were either 6 or 7 years old (ranging from 6,1 to 7,6) and were chosen randomly from classes at two separate schools. All children (except one native-English African girl in the low-SES children) were white, native-English speaking and Irish. In both dyads children were classmates and knew each other before the session. No attempt was made to establish a baseline of language skills.

In both high- and low-SES conditions, children were given 20 minutes to play with TellTale. As a story elicitor, children were given a sample narrative setting on which to base their story (TellTale was lost in the forest and met a new friend) and were then left with several open-ended questions to help facilitate their storytelling. (*E.g.* what kind of forest creature did he meet? What's the forest creature's name? Where did he meet his friend?)

In both conditions, the experimenter was in the room, sitting at a separate table. In all sessions, the children's play was video-taped and audio-recorded. The experimenter later transcribed and analyzed the data for the following story features: at least one story "event"; at least one conjunctive phrase (from the same set used for the previous study: {and, then, however, when, while, after, later, so, therefore, one day}) at the beginning of the utterance or at the end of the utterance; whether co-participants' utterances were co-occurring. Qualitative observations were also made for all sessions, specifically focusing on how children mediated turn-taking during play.

An important note: although there is much debate about what constitutes a narrative, for the purposes of this study, a recording was considered a "story" if it contained at least one change in character, place and/or time (Berman and Slobin, 1994).

Sample Story

The following is a transcript segment from stories recorded by two high-SES children. Bold text represents the recordings of one participant and normal text represents the recordings of the other participant. The turn column indicates a single child's turn. Although children always had five TellTale body pieces available, they often used only a subset of these. (For example, in this sample, the children only used two body pieces.)

Table #1: Two high SES 6-year old children recording a story with TellTale

Turn	Body Piece #1	Body Piece #2
1	**This is a story about a caterpillar who moved into a new town.**	
2		And he had no friends.

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3	So he wanted to make new friends. All the other friends … all the other people that were his friends when he just moved into the new town. He didn't make any new friends because he was too scared.	
4		He went to school and he made one new friend but he was too scared to talk to him.
5	So then he made a new friend.	
6		And he started talking to him and he was … [with a slight pause and rising intonation]
7	And then the friend, the new friend, ran away.	
8	And then when we wanted to make a new friend, that friend wouldn't be his new friend.	
9		So he had to go and make another friend. He went deeper into the forest and he made one new friend [stops recording and looks directly at other child].
10	But then, he got lost and he couldn't go back home.	
11		So the other friend brought him to his house and took care of him until he found the way back home.
12	But then … but when he found home he left back for school. When he went back to school all his friends were gone [this last word was drawn out and ended with a direct gaze at the other child].	
13		And he was really sad because he had no friends then. And then he had to go deeper into the forest to find his other friend but he couldn't because he wasn't well.
14	But then he found … he found … a wolf and then when the wolf saw him he started to creep up into a leaf.	
15		And the caterpillar heard so he went back and he found his friends and then he climbed up the tree into his house.
16	But then, before he got into his house he slipped up the tree and then he went back up the tree and then he got into his house.	
17		And that was the story of the caterpillar.
18	And then he went out to find his friend. And when he found his friend all the others wanted to be his friend.	
19	And then when he found his friends he went home and he had the best day of his life [stops recording and gestures to other child].	
20		When the caterpillar went to school all his friends were there and they all became his friends.
21	Then all his friends brought him to the forest to do a test so that would be his test to be his friends.	
22		And then he saw his other caterpillar friend that took care of him when he was ill. He was lost [at this point, the other child whispered "in the forest"] in the forest and the caterpillar was all on his own so the other caterpillar went and played with him.

Quantitative Results

Children from both high- and low-SES groups consistently recorded utterances that contained story events (in both conditions, approximately 75% of all children's recordings contained at least one event).

Children from both high- and low-SES groups also used connectives at TellTale body piece boundaries but children from high-SES consistently used more connectives. Furthermore, children from high-SES used more conjunctives at

both the end and beginning of utterances: 31% of high-SES children's utterances contained conjunctive phrases at the beginning whereas 14% of low-SES children's utterances contained conjunctive phrases at the beginning; 11% of high-SES children's utterances contained conjunctive phrases at the end whereas 6% of low-SES children's utterances contained conjunctive phrases at the end.

Another feature along which children's recordings were analyzed was co-occurring utterances (*i.e.* when the two participants were recording utterances simultaneously): 4% of high-SES children's utterances were co-occurring whereas 31% of low-SES children's utterances were co-occurring.

Figure 4: Features of Children's TellTale Stories
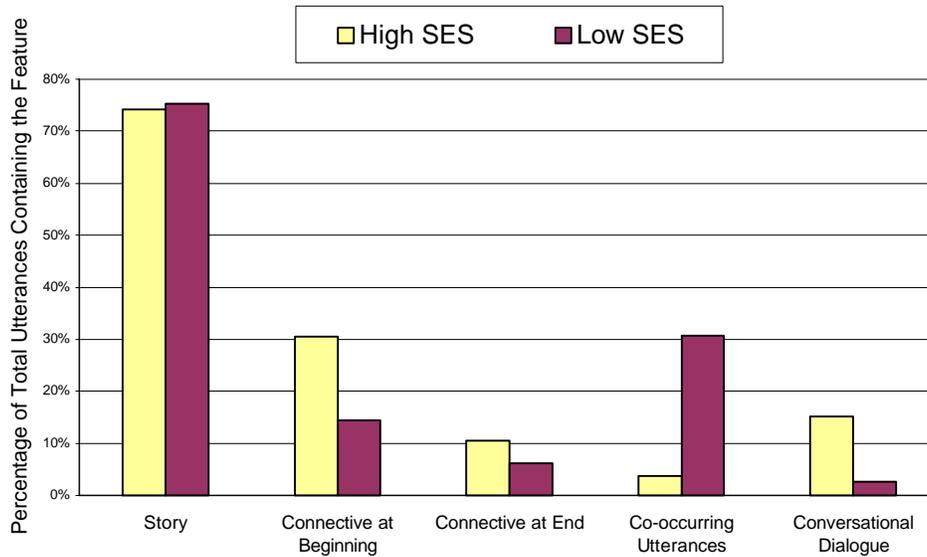
Children also used TellTale to record conversations between themselves. For example, some children used body pieces recordings to stand for dialogue turns with one child recording "Hi, how are you?" with a body piece and the other child responding with "Fine, I guess but I'm trying to work on a story." Along this feature, there seems to be a difference between how high- and low-SES children used TellTale: 15% of high-SES children's utterances were dialogue turns of this kind while only 2% of low-SES children's utterances contained such conversation.

Qualitative Results

General Observations
As in earlier studies, TellTale's discrete body pieces seemed to encourage children to segment and organize audio. TellTale also again elicited stories that very strongly resemble those children tell in natural environments. But there are specific features of children's collaborative story-telling play that can be described in more detail:

Incorporations
During collaborative play, children often include aspects of their partner's language in their own. Since TellTale's body pieces encourage children to segment language, it was thought that children may establish coherence among these segments by incorporating aspects of their other child's recording.

Both high- and low-SES children consistently incorporated both narrative (characters, places, actions) and syntactic (exact word phrases) aspects of their partner's utterance into their own. For example, in Table #1 (the high-SES condition) both children consistently refer to a friend until turn 9 after it was introduced in turn 1. And when one child introduced the home/house as a setting, the other child incorporated this into his recording; the house became the story's setting until approximately turn 16. Then, in turn 22, one child whispered to the other child the exact phrase to record ("in the forest"). Similar instances were seen in the stories of low-SES children.

But although in both conditions children were incorporating each other's content, preliminary qualitative observations seem to suggest that low-SES children tended to make incorporations simultaneously (*i.e.* during co-occurring recordings) whereas high-SES children tended to incorporate each other's content across consecutive recordings.

Turn-Taking
Children from both high- and low-SES consistently engaged in turn-taking through both paralinguistic means (*e.g.* rising and falling intonation) and non-verbal means (*e.g.* gestures and eye-gaze).

However, preliminary review of the data suggests that children from low-SES group usually tended to use either no turn-taking strategy or the more non-syntactic turn-taking strategies (*e.g.* paralinguistic and non-verbal). Also note that in Table 1 (*e.g.* turns 6, 9 and 12) children used non-verbal and paralinguistic techniques to indicate that the other child should take the turn.

In contrast, high-SES children tended to indicate turn-taking through more explicit syntax-based strategies. For example, they would often begin their recording with a conjunctive phrase to indicate that they wished to have the turn or end a recording with a conjunctive phrase to indicate that the other child should the turn (as show in the quantitative results section, this latter case was less likely).

Physical Play
While playing with TellTale, children would often move around the room, make theatric gestures and incorporate other props into their story construction. The entire physical space became a language play area: children would hide in corners and under tables to make recordings; whisper their words while staring at each other or closing their eyes; link certain pieces to create sub-stories; and transform the body pieces into action figures, space ships and many other imaginary objects.

Discussion
Overall, children from different socio-economic strata tended to engage in slightly different behaviors during collaborative storytelling. Although both groups consistently recorded what are considered to be traditional, well-formed stories, the two groups seemed to be using different strategies to establish coherence between both their story elements and their social interactions. Specifically, an initial analysis may interpret low-SES children's high percentage of co-occurring utterances and low percentage of syntactic connectives as an indication that they are less able to engage in good turn-taking behavior and that they are less aware of their co-participant.

But the qualitative data suggest that this may not be the case for two reasons: low-SES children appear to be using more subtle (*e.g.* non-syntactic, paralinguistic and non-verbal) strategies to indicate turn-taking during story construction. Also, despite the high percentage of co-occurring utterances in low-SES children's recordings, these children consistently incorporated elements of their partner's utterances simultaneously. (Children from high-SES tended to establish coherence using syntactic connectives between consecutive recordings.)

Also note that children from high-SES tended to use TellTale body pieces for conversational dialogue, perhaps relying on the interlocutor to "contextualize" their language by providing explicit feedback. In contrast, low-SES children were able to construct stories without direct dialogue. These data are not strong enough to state conclusively whether children of high- or low-SES are "better" or "worse" at collaborative language play. They do, however, suggest that purely syntactic measures of collaboration that only consider the use of conjunctive phrases and canonical turn-taking may not be reliable indicators of language facility.

The location of conjunctive phrases also suggests an interesting and perhaps new finding. In both high- and low-SES conditions, children were more likely to use connectives to link the beginning of their recordings to the previous recording and less likely to use connectives to link the end of the recording to the subsequent recording. This reliable pattern suggests that, when children are establishing narrative coherence, they may be more focused on linking with previous content than linking to future content.

Conjunctive phrases seem to be linked to turn-taking strategies. Both high- and low-SES children appear to be more willing to use a connective at the beginning of their recordings to *take* the turn from their partners than at the end of a recording to *give* the turn to their partners. This finding suggests that conjunctive phrases may be used as devices to indicate cohesion or strategies for turn-taking – or both. It also suggests that TellTale seems to mediate both story construction and play.

The qualitative observations also support the idea that a tangible interface may an appropriate tool for supporting young children's language play. Children recorded while wandering the room and easily incorporated their physical

surroundings into their play behavior. It is unlikely that they would engage in such natural collaborative play while using a traditional desktop-based GUI.

USER STUDY #2: TELLTALE AND GROUP AUTHORSHIP (A PILOT)

The first user study focused on how two children use TellTale but offered little insight into how TellTale may support group language play. Although this study was only a pilot investigation, several interesting observations were made concerning children's collaborative use of TellTale.

Method

A total of 7 children in two groups played in this condition. The first group consisted of four girls all 7-years old and all from the same classroom participating as part of a school trip. The second group consisted of three brothers aged 3, 5 and 7. Like the first study, children were given 20 minutes to play with TellTale while the experimenter was in the room (but not participating in the activity). All video and audio recordings were transcribed by the experimenter.

Observations and Discussion

Although the data are not strong enough to support any claims about children's collaborative language play, the group observations suggest that TellTale is an engaging and social interface when used by more than two children and that groups of children use TellTale in slightly different ways than pairs of children.

Across all groups, children worked together to build stories, each child taking responsibility for a single body part and usually alternating turns with another child. In the first group one girl also assumed responsibility for TellTale's head piece and called herself "the publisher." Children debated about what exactly should be recorded in each body piece and sometimes used the fifth body piece to record, in unison, their names as the authors. In the first group, at one point the story became complex and there was much debate over exactly what should be said in the fourth body piece. One child wrote with a crayon on a piece of paper exactly what she thought should be said – "so we'll know for sure" – indicating that these children were comfortable mixing written authorship with oral storytelling during the play session.

When children were asked what would happen if TellTale pieces were in another configuration, children in both groups responded that "it just wouldn't sound right" and "would make the story wrong." One girl in the first group said "I'll show you how bad it is" and proceeded to assemble the pieces in the incorrect audio to illustrate her point.

In the other group play sessions, a 7-year old child creatively used TellTale to solve his brothers' problem. After the 5-year old and 3-year old brothers had recorded into four of the five body pieces, they expressed concern that there was only one body piece remaining. The 7-year old brother then held down the record button on the fifth body piece while playing back the first four in sequence, in effect "copying" the audio of the first four body pieces into the fifth and freeing four body pieces.

Although these data are not strong enough to support any strong claims about how more than two children may use TellTale in a group authorship, it was interesting to see children using the interface in such an unanticipated way, suggesting that TellTale's flexible and underdetermined interface encourages creative uses.

CONCLUSIONS

This paper presented the rationale, design and evaluation of a new tangible toy, TellTale. Its design was based on a theory of emergent literacy that suggests that children acquire literacy skills through immersion in social environments that support both oral and written language skills. TellTale is one tool designed to be used in such an environment. It is intended to support young children's collaborative oral language play in a way that lets them practice composition skills that will be critical for later written literacy.

One user study found that paired children who use TellTale do indeed practice different social and linguistic skills important for later literacy and that children of different socio-economic strata may use different strategies to establish cohesion in oral stories. A second user study – although inconclusive – suggests that the toy may also support authorship among more than two children.

While TellTale only supports certain kinds of behaviors with young children, its theory and evaluation suggest that there is a new opportunity to use technology to support children's language development through the creation of new media and collaborative play.

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