

Stories and Voice Agents to Inspire Preschool Children’s Social Play: An Experience with StoryCarnival

Inspiring Preschool Children’s Social Play

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In a post-lockdown context with significant concerns about children’s social skills, it is important for technologies to play a positive role in supporting children across cultures, settings, and backgrounds. The research presented in this work-in-progress is about StoryCarnival, a technology designed to promote creative, social role play among preschool children. We conducted StoryCarnival play sessions for three weeks with a group of 3–4-year-old children in Montevideo, Uruguay, a very different setting from the one where StoryCarnival was designed. We present preliminary results suggesting the activities resulted in a significant increase in children’s social play. We also discuss the impact of cultural differences and describe experiences with some features of StoryCarnival that had not previously been used in the field.

CCS CONCEPTS •Human-centered computing~Human computer interaction (HCI) •Social and professional topics~User characteristics~Age~Children

Additional Keywords and Phrases: preschool children, social play, role play, voice agent, teleoperation, cultural factors

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1 INTRODUCTION

Prevailing uses of computing by young children often involve socially isolating experiences [17], passive consumption of media [17], and activities structured by technology [17], together with poor privacy practices [15] and the risk for addiction [14]. This is all happening at a crucial time during child development [10] and in a post-lockdown context with high levels

of concern for children’s social skills and mental health [12,16,18]. There is a need to research alternative models of child-computer interaction that are more likely to benefit young children.

In the research presented in this work-in-progress, we studied a privacy-preserving technology designed to support creative, social play for preschool children: StoryCarnival. StoryCarnival [7,19,20] is a technology designed to support play in the style of the Tools of the Mind approach to early childhood education [5]. Multiple large studies provide evidence of the positive impact of Tools of the Mind on children’s executive function skills, a set of cognitive and affective skills that contribute to people’s ability to self-regulate and adjust their behavior in different contexts in order to achieve goals [1,9], and academic success [3,4,8,9,13]. Play in the style of Tools of the Mind, with its Vygotskian roots [5], puts a strong emphasis on groups of children playing with common goals based on story settings known by all participants, planning, role-play (children pretending to be characters in the selected story setting), interactive social dialogue and negotiation, improvisation, and the use of generic physical props as opposed to realistic toys to stand for any object relevant to play [5].

StoryCarnival aims to remove barriers to implementing this type of play that currently requires a significant amount of teacher training [3]. It was developed through participatory activities at a preschool in the United States [19] and consists of three components. First, e-book style stories that present multiple co-dependent characters of equal importance who face a situation that is left to children to resolve through role play. Second, a play planner to support children selecting the character they will play. Both of these components are available through a web app or in print. Third, a tangible, teleoperated voice agent called MiniBird, whose synthesized speech is controlled by the adults running a play session, used to support children during play.

Prior research on StoryCarnival has reported on its use to support participatory design with preschool children [19] and how it may help shy children join social play [7]. However, both those activities were conducted in a very similar setting to the one where StoryCarnival was developed. A relevant question is how well it would work in different contexts. In addition, we had limited experience using the redesigns of StoryCarnival’s voice agent, its teleoperation user interface, and the use of story templates that enable Mad Libs [21] style stories.

2 RESEARCH GOALS

The main goal of this study was to begin to understand the impact of StoryCarnival on preschool children’s social play in a geographic and cultural context different from the one where the system was designed, developed, and previously evaluated. In addition, the study was an opportunity to obtain feedback on some new StoryCarnival features, including a new design for the voice agent, a streamlined teleoperation user interface, and story templates.

3 RESEARCH SETUP

3.1 Setting and Participants

The study was conducted at a private preschool in a middle-class neighborhood in Montevideo, Uruguay in late July and early August of 2022. This preschool follows the Reggio Emilia approach to early childhood education [11]. This approach emphasizes child-led, project-based activities together with exploration and creativity [11]. We recruited 11 3-4-year-old children from the same classroom, 7 boys and 4 girls. Parents reported that 6 of the children used tablets regularly, typically for one to two hours a day, with YouTube being the most common app. None of the children used a voice assistant. We conducted the sessions in a dedicated room with a table and chairs sized for preschool children. None of the children had a diagnosed disability, although one boy spoke very little and only in single syllables.

3.2 Materials and Procedure

We used a development version of StoryCarnival that was the same as the publicly available version as of July 2022, except it had Spanish content available. We also used a design of the voice agent different from those used in prior StoryCarnival research. This version consists of a transparent, soft plastic cube (2 inches per side), with artwork representing the MiniBird character (Pajarito in Spanish), and a Bluetooth speaker inside.

We conducted 1-2 weekday sessions over three weeks, with 10 sessions during the first week, 9 sessions during the second week, 8 sessions during the third week. Each child participated in no more than 5 sessions per week. The number of sessions and children per session varied due to illnesses, with the lowest number of children present on a given day being 5 and the highest 11. We worked with groups of at least 3 and no more than 6 children, meaning that most days we split children into two groups.



During sessions, children interacted with one researcher from the team while another video recorded the session. We started by presenting a StoryCarnival story using a tablet. For about half the stories in a given week we used StoryCarnival’s story templates asking children to select story components that they would then see in the story. Then, we used the same tablet to help children select which character to play through StoryCarnival’s play planner. This part of the activity took about 5 minutes. We then gave children blocks provided by their preschool to play within the story theme. We also gave them the MiniBird voice agent. During the first and third week, we did not use the teleoperation interface to make MiniBird speak. During the second week, the researcher interacting with children controlled MiniBird’s speech from their smartphone. This latter part of the activity took 15-20 minutes.

Figure 1. Version of voice agent used during study held in an adult’s hand.

3.3 Data Collection and Analysis

To gather preliminary results for the activities, the researchers present in a given session filled out a modified version of the Preschool Play Behavior Scale [6] (PPBS) after each session. The questions in the scale aim to assess the degree of individual versus social play for preschool children. The questions were intended for teachers to assess a series of behaviors on a five-point scale going from “never” to “very often”. We used a modified version of the survey to count how many children in a session fit each rating for a question, rather than scoring each child individually. In addition, we added the following four questions related to StoryCarnival goals: acts out scenes within the theme of the story, plays symbolically with physical objects, discusses with others what to do next, and coordinates play with others. All questions were presented in English as all the researchers who participated in the sessions were fluent in both English and Spanish.

To analyze the results of these surveys for this work-in-progress, we took the first two sessions, the two middle sessions, and the last two sessions from each week of research activities. We normalized the ratings under each question, such that we obtained the percent of children under each rating for each question. We then developed a score for each question by multiplying the rating (1-5) times the percent of children under the rating (e.g., if all children were rated at a 5, then the score would be 5). We then took the mean of each of these scores for each pair of sessions at the beginning, middle, and end of a week of activities.

In addition to the use of the PPBS we also report on notes taken by the first author after sessions to anticipate possible items to look for when analyzing video recordings of the sessions.

4 RESULTS

4.1 Social Play

The PPBS includes six questions that specifically measure social play: talks to other children during play, plays “make believe” with other children, engages in group play, plays in groups (not just beside) other children, engages in active conversations with other children, and engages in pretend play with other children.

The progression of PPBS ratings for these questions presents a relatively stable pattern that begins to point to improvements by the second set of observations during week 2 of the study, with marked improvements by the end of week 3. For all the measures of social play except one (“talks to other children during play”) there was an increase in ratings of at least 60 percent between the end of week 1 and the end of week 3. Of note is that when the stability of the PPBS was studied, its creators asked teachers to rate the same children’s play six months apart. They found that the social play measures were stable with $r = .65$. While they did not specify the specific type of correlation they used, we assume it was Spearman’s correlation given the type of data involved. In our case, when comparing ratings from the first and last weeks of the study, we found $r = .35$, suggesting much lower stability. We also ran an intraclass correlation coefficient analysis finding Cronbach’s $\alpha = -.516$. Both these results suggest a lack of stability between weeks 1 and 3 of the activities with respect to social play, suggesting in turn that the changes were likely due to the intervention rather than maturation. Below, the chart on the left of Figure 2 shows the progression of scores across the three weeks of observations (observations 1-3 are for week 1, 4-6 for week 2, 7-9 for week 3). We found a similar pattern in the two questions we added to the PPBS that address social aspects, such as discussing what to do next or coordinating, as illustrated below on the right-hand side chart of Figure 2. Improvements in these more advanced behaviors lagged those for the PPBS questions.

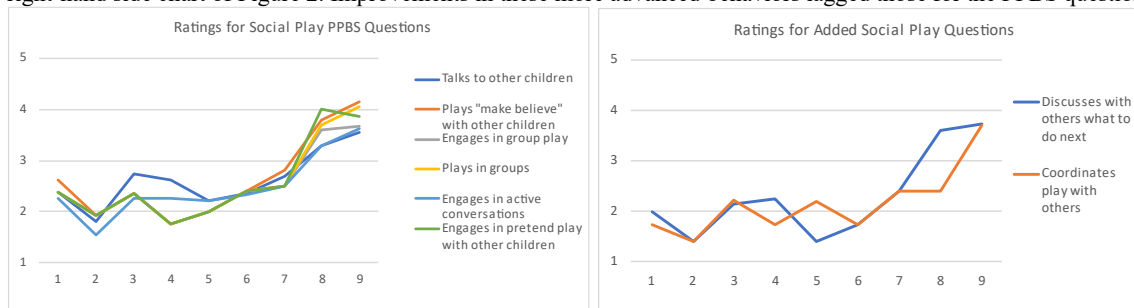


Figure 2. On the left, ratings for social play measures under the PPBS. On the right, ratings for added social play questions based on StoryCarnival goals.

4.2 Other Behaviors Targeted by Tools of the Mind and StoryCarnival

For the questions asking about children playing within the theme of the story presented to them and playing symbolically (both goals of Tools of the Mind and StoryCarnival), children scored consistently high throughout the three weeks, with all pairs of sessions scoring above or near a rating of 3 (sometimes), and no clear temporal pattern.

4.3 Cultural Aspects

While there were differences in how the sessions worked out due to geographic and cultural differences, these did not seem to have an impact on the ability to run StoryCarnival sessions. One big difference with sessions conducted in the United States is that the children in this study did most of their play sitting on chairs and sharing a table. This is because the study was conducted in winter and the classrooms had tile floors, which were hard and cold, unlike the typical carpeted floors at

preschools in the United States. The main consequence of the difference is that unlike children participating in StoryCarnival sessions in the United States, the ones in this study made less use of the physical space to stand for locations during their play, although in a few occasions they got up and walked around pretending to go to other places.

In terms of language and content of the stories, there were minor issues with story elements that are not so common in Uruguay, such as sushi, which we had to explain to children. There were no problems with uses of Spanish that are not common to Uruguay. The translations into Spanish attempted to use the type of Spanish used to dub cartoons. For example, for a story about a birthday party, the cake is referred to as “pastel” rather than “torta”, which would be the right term in Uruguay. However, children picked up on it without any issues as they had likely heard “pastel” used to stand for cake in media they had previously experienced. To our surprise, children were also very forgiving of minor mistakes in the voice agent’s speech, which we have since fixed. They did not even seem to notice them.

4.4 Voice Agent Teleoperation and Children’s Reactions to Voice Agent Speech

In prior published studies using StoryCarnival, researchers controlled the voice agent’s speech by typing text on a laptop, which was not very practical [7]. This study used a user interface intended primarily for use on mobile devices. The user interface presents speech options related to the story children just experienced organized in categories, with each category having multiple speech options accessible by pressing the button corresponding to a category multiple times (see Figure 3,

with the English version). The categories include speech related to events in the story, to expand the story (both of these categories include speech directed at specific characters), to encourage children to collaborate, and to provide praise. The text to be synthesized appears in a box below, and once a user identifies text that would work given the context, they can press the Submit button. The text can also be modified or typed from scratch.

Figure 3. User interface to generate speech for voice agent.

The user interface worked very well during week 2, when we made the voice agent speak. During these sessions, one researcher interacted with children and controlled the voice agent from a smartphone, while the other researcher video recorded the session. Previous research with StoryCarnival that used the user interface that required typing pointed at the difficulty of having the same person controlling the voice agent and interacting with children [7]. Using the new user interface greatly simplified control of the voice agent, which largely involved using suggested speech by tapping on an appropriate category until a suitable option appeared, then pressing the Submit button. Typed in speech was used infrequently, typically when there were opportunities for the agent to say something very contextual. For example, when one child asked the voice agent “¿Estás loquito Pajarito?” (Are you a bit crazy MiniBird?), the researcher typed in a reply “Estoy loquito por jugar con vos” (I’m a bit crazy about playing with you), which resulted in general laughter and a level of amazement. These occasions led to “moments of joy” when the voice agent happened to say something funny or very opportune. It is possible these moments could make children more interested in the activities. We also noticed a few occasions of the voice agent’s speech convincing children to play nicer with their classmates, such as sharing a block they did not want to give up. During week 3, when the voice agent did not speak again, children did miss its speech, sometimes, at our suggestion, using their own voices to make the voice agent talk. Something else we noted with the teleoperation of

the voice agent is that children did not mind that the researcher was using their smartphone while interacting with them. It is possible that by now children are used to adults using smartphones while interacting with them.

5 DISCUSSION

The preliminary results of this study suggest that StoryCarnival may be useful in a variety of preschool settings. In other words, it can have different yet complementary impacts in preschools with different curricula and dissimilar cultural contexts. For example, it can help integrate children who would otherwise be disengaged from the activities in a traditional preschool in the United States [7] or promote social aspects of play as the preliminary results suggest it did in this occasion. The use of the Reggio Emilia curriculum likely explains why children were very engaged throughout, playing within the theme of the story presented to them, as well as making symbolic use of physical objects. The one area where the children struggled initially was in playing together as opposed to playing in parallel. As the play sessions went on, this is where they made gains, as pointed out in the results section, which was the main positive outcome of the study. Our sense as we were conducting the study was that if it had gone on for another week, it is likely that StoryCarnival would have stopped being necessary to help children gain social skills. In other words, it would have done its job as a scaffold.

Having the voice agent speak did not seem to have an impact on any of the questions in the survey filled out by researchers after each session. However, the children clearly enjoyed interacting with the agent and showed affection toward it, suggesting that it could be a factor in making the activities more enjoyable and providing teachers with an alternative form of communication.

5.1 Limitations and Future Work

There is a reason why we submitted this work as a work-in-progress because that is what it is. At this point the results are preliminary. Coding video recordings will be necessary for a rigorous analysis of the sessions, which is the next step we plan to pursue with respect to this study. The preliminary results do point us in specific directions where to focus our analysis, in particular social play and interactions with peers.

6 CONCLUSION

The study presented in this work-in-progress suggests that technologies like StoryCarnival, which are used to inspire activities rather than being the center of attention could have a relatively quick and substantial impact on children's social play. We also found the technology to be resilient to geographic and cultural differences. In addition, we confirmed that the user interface for teleoperating the voice agent worked well, enabling one adult to run sessions.

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8 SELECTION AND PARTICIPATION OF CHILDREN

The study protocol was approved by the Ethics Board of the Universidad de la República. We obtained informed consent from parents or caregivers. We provided children's parents or guardians with detailed information about the study, data analysis, and future use of the collected data. We also hosted an informational session for parents or guardians to answer any questions. They were also encouraged to contact the research team if they had any questions or comments about it. We

invited children to participate in our activities, but children decided how engaged (or not) they wanted to be. All methods were in accordance with the Declaration of Helsinki [2].

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