

# Tell Me a Story: NLI& and Children's Websites



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## *Natural Language Interfaces and Children*

A national survey of children 10-17 years old, conducted in December 1999 by an American group including National Public Radio, illustrates the relationship between children and technology clearly: kids love computers and happily advocate using computers to do schoolwork, play games, and surf the Internet. However, 37% of kids without computer access at home were quick to point out that they feel "left out."<sup>1</sup>

Overall, 49% of the children said that they were annoyed by the inability to find the information that they wanted while using a computer. The statistic is not surprising. A standard web search using *Google* gives mixed results for any topic. For instance, a keyword search for "lion" returns 38 hits for corporate and miscellaneous sites before displaying a site about lions, specifically. Compound the frustration with spelling and typing difficulties and it's no wonder that nearly 50% of the kids surveyed were unsatisfied with their ability to find information.

Children younger than 10 will experience even more problems with spelling and input devices. There is a need for input devices that are appropriately sized for children and some companies (e.g., KidzMouse, Inc.<sup>2</sup>) are acknowledging the demand. Other companies, such as Little Tykes, are creating keyboards with pictures and letters on the keys to help young computer users<sup>3</sup>. However, the keyboard size is standard, so the stretch between individual keys is still difficult.

An Internet site that does not require input from a keyboard or a mouse is a logical solution for a demographic that is linguistically inclined, but challenged by technicalities such as spelling. A Natural Language Interface could be the ideal solution. The following paper examines the integration of a Natural Language Interface with a story website aimed at children ages 3 to 8.

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<sup>1</sup> [http://www.futureofchildren.org/cct/cct\\_10.pdf](http://www.futureofchildren.org/cct/cct_10.pdf)

<sup>2</sup> <http://www.kidzmouse.com/kidzstore.html>

<sup>3</sup> <http://www.webchild.com/kidboard.htm>

### *Advantages*

A Natural Language Interface in conjunction with a children's website provides greater access to:

- a large variety of stories from other cultures and writers
- an easy method of finding stories that interest the child (i.e., a restricted keyword search)
- connections between spoken language and print, via a "follow the bouncing ball" animation
- a safe, interesting introduction to the Internet.

### *Disadvantages*

However, a Natural Language Interface with a children's site raises the following concerns about:

- young children's ability to remember the interface (i.e., keywords)
- obtaining "correct" responses from the users
- ethical considerations for children online without supervision.

### *The StoryTime Site*

Candlelight Stories<sup>4</sup> is a website that provides text, audio, and animated stories, as well as games and other forms of children's entertainment. However, due to the wide variety of activities available on the site and the lack of clear navigation, a prototype site, StoryTime, was developed. The new website is essentially a portal for the database of stories associated with the website. With the exception of site information for parents and a sitemap, there are no pages to navigate in the site. Any links to a specific story are generated by a search field. The flat structure of the site enables easy integration with the NLI, and simplifies the site navigation for children who are not using the NLI.

View a demo of the StoryTime Natural Language Interface at <http://opal.sio2.ca/481v/index.html>. Please note that due to time and technical constraints the demo is compatible with Internet Explorer only.

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<sup>4</sup> <http://www.candlelightstories.com/>

## *Anthropomorphism and the NLI*

The concept of anthropomorphism is well received by some interface specialists and discouraged by others. For instance, Boyce encourages the use of "I" by the computer and says that a system that uses first person scores higher on user satisfaction than one that does not.

However, typical children's television programming is specifically catered to anthropomorphism. Pee-wee's Playhouse from the mid-1980s is a good example of anthropomorphism, since the show featured talking furniture and house parts as characters. Given the age group of StoryTime's intended audience, children who use the StoryTime site will apply human qualities to system, regardless of how lifelike or artificial the interface is.

### *Choosing a Character*

Similar to the Microsoft Office Assistant, the StoryTime Robot (or "Robbie the Robot," as the skin is called) is a component of the interface at all times. The character actively participates in the site, and the gestures of the character help clarify the dialogue. A low-bandwidth version of the site might minimize the character animation, or provide the option to turn off the character altogether when a story is being read.



Integrating a character into the site reduces the possibility that users will assume that they are talking to a person instead of the machine. The character will also appeal to children and encourage them to continue using the site. Also, as Druin and her co-authors tell readers in "Children as Our Technology Design Partners," "it used to be that technology could get away without sound, but thanks to video games, TV, movies, and so on, kids want a multisensory experience" (67).

### *Choosing a Voice and Gender*

Selecting a voice and tone for the site is difficult. The interface must appeal to children and provide information without talking down to them. The system should be pleasant, inviting, and have a pleasing personality. In other words, the voice and attitude given to the character must entertain and educate simultaneously.

Originally, the StoryTime site was intended to incorporate only a voice and a typical graphical user interface. However, the site needs to incorporate a synthesized voice, due to the enormous combinations of speech the interface must handle. To capitalize on the synthesized voice, a cartoon robot is an appropriate choice for the character.

There are equal advantages and disadvantages to using a male or female voice. Females are, typically, teachers of children in the 3 to 8 age group, therefore casting a male voice for StoryTime would discourage gender-related job stereotyping. Likewise, since the technology field is still dominated by males, casting a female voice for the StoryTime robot discourages a sexist technology outlook.

Eventually, a female voice was cast for the StoryTime robot. As Randy Harris suggested "a female [character is best]; it buys into all sorts of stereotypes, but stereotypes are not arbitrary and are not always malicious. Children tend to trust women more immediately." Any stereotypical takes on the female teaching position of StoryTime are lessened by the fact that many of the individual stories would have different, pre-recorded narrators from a variety of backgrounds.

## *NLI and GUI Integration*

Integrating a Natural Language Interface with a Graphical User Interface has a number of advantages. The ability to switch between keyboard, mouse, and voice input, depending on the user's preference, helps minimize user frustration when one input method is inadequate. For instance, if the StoryTime server has too many users for the Natural Language Interface to work at full speed, entering a story request with the keyboard would get the user to a story of his or her choice quickly.<sup>5</sup>

### *Switching Between Speakers and Modes*

In the book *Conversation Analysis*, Hutchby and Woofit discuss the concept of turn-taking. In other words, they describe the typical pattern of conversation, in which the dialogue is split evenly between the participants with a minimal amount of gap and overlap between the speakers. Certain signs indicate when one participant is done speaking and the next may begin to comment.

In the case of StoryTime, pauses are the best way to signify the end of a turn. The StoryTime robot would begin talking two to three seconds after the user finishes his or her turn. This length of time, according to Weinschenk and Barker, is an acceptable delay when processing information. A delay longer than three seconds calls for an acknowledgment from the system that the request was heard and is being processed. Otherwise, users begin to believe that the system has crashed.

For StoryTime to indicate that a mode switch is required, it will have to state the mode switch explicitly. For instance, StoryTime would say after asking for a clarification of the user's request, "I don't understand what kind of story you want. Please enter the story in the text box near my feet so I can find your story and remember it for next time."

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<sup>5</sup> This is based on the assumption that a web NLI works on the same principal as a telephone NLI.

### *Handling Consecutive Multi-modal Input*

StoryTime has the potential to accept information from voice, keyboard, or mouse simultaneously. Since the robot interface is available at all times, unless it is specifically turned off by the user, there is no reason why the user cannot click around the site and carry on a dialogue with StoryTime simultaneously.

When information is entered via keyboard and voice interface simultaneously, StoryTime performs a compound search for a story that fits both parameters, then each parameter separately.

For instance, if the user enters "lion" in the search box, and tells StoryTime to find a story about a "lamb" at the same time, StoryTime returns a story about a lion and a lamb. If such a story is unavailable, StoryTime asks, "would you like a story about a lamb instead?" A "yes" answer causes StoryTime to list stories about lambs, while a "no" answer causes StoryTime to ask the user, "would you like a story about a lion?" A "yes" causes a StoryTime to list stories about lions, while a "no" answer results in StoryTime asking for a new search.

## *Considering Vocabulary*

Special consideration must be given to the keywords added to the initial site dictionaries. Words used by adults are not the same as those used by children. Ideally, wizard of oz or usability testing should be performed to obtain any extra words that are not already contained in a standard Natural Language Interface dictionary. However, that sort of research is beyond the scope of this report.

## *Integrating Popular Culture*

The interface must deal with a society that encourages media participation. As a result, the dictionary must be constantly updated with terms from popular culture, for example, terms from standard children's television programming.

While the site may not include stories about Pingu, the system must recognize the term. Ideally, whoever is adding to the system will make an association between the specific, proprietary term and a more general term. For instance, if the term "Pingu" does not exist in the story database, the dictionary module could return results for "penguin.". While the interface may be unable to reply with a story specifically about Pingu, it can return a story about a generic penguin.

Special attention should be paid to user input that cannot be dealt with directly. If the site has 400 hits a day asking for Pingu, attempts could be made to acquire stories about Pingu in response to the demand.

Likewise, a site administrator must update the dictionary with new references to characters from television shows, websites, and books in order to maintain the system's ability to substitute stories for proprietary works that do not exist in the database.

## System Features

StoryTime includes a number of features in addition to the Natural Language Interface, including memory, low bandwidth, and barge-in functionality.

### Memory

Children have a tendency to request repetition—just ask anyone who has watched the same Disney movie 46 times—and StoryTime caters to this demand by using cookies. Stored on the user's hard drive, the cookies indicate which stories the user has heard. A query for a story about bunnies causes StoryTime to check the stored cookies for stories about bunnies before searching the site. If StoryTime finds a match in the cookies, it will say, "you heard a story about a bunny before, would you like to hear it again?" A "yes" results in the story being played, a "no" causes a search of the StoryTime site for a new bunny story.

During a dialogue with a user, a short-term memory of the exchange is stored in a stack. This short-term memory enables shortcuts in the conversation, since the system can track implied topics that are often taken for granted in a human-to-human exchange.

For example, dialogues like this one:

StoryTime What kind of story would you like to read today?

User One about bears

StoryTime <provides list of stories, determines that the interface is reading, finishes story>

User I like that. Read me another one.

StoryTime What kind of story would you like me to read?

User One about bears.

become simpler and less frustrating for the user when the system tracks keywords from previous portions of the dialogue:

StoryTime What kind of story would you like to read today?

User One about bears

StoryTime <provides list of stories, determines that the interface is reading, finishes story>

User I like that. Read me another one.

StoryTime <retrieves last story keyword from stack> I have two more stories about bears. Would you like to hear this one <reads description>?

User Yeah!

### *Bandwidth Relief*

The integration of the Microsoft Agent<sup>6</sup> software with the site is also advantageous for the user. The character and programmed actions are loaded onto the user's hard drive, reducing the amount of bandwidth required by the StoryTime site and decreasing the chance of the user experiencing system lag.

As mentioned in [Choosing a Character](#), a low-bandwidth version of the site would also minimize the amount of character animation, and provide the option to turn off the character altogether when a story is being read. These alterations reduce the amount of bandwidth required to run the interface, and make the site more accessible to users with dialup connections.

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<sup>6</sup> <http://www.msagentring.org/>

### *Barge-in Functionality*

Barge-in functionality allows the user to interrupt StoryTime at any point during the dialogue. This ability permits advanced users to move through the system quickly, for instance, a conversation with an advanced user might look like this:

StoryTime Hello. I'm StoryTi--

User I want a story about frogs.

StoryTime Okay, I have three stories about frogs. The first one is about Jeremiah the Bullfrog. Would you like t--

User Read me the story.

StoryTime Once upon a time...

Barge-in functionality also allows the user to correct misunderstandings when they occur. For example,

StoryTime What type of story would you like to read today?

User I want a story about dogs.

StoryTime I have two stories about bogs. Wou --

User No! *DOGS*.

StoryTime Whoops! Sorry! I have three stories about dogs...

Interrupting another speaker's turn to make a correction is a natural tendency in conversation, especially with an impatient demographic of 3 to 8 year olds, so StoryTime must be able to handle barge-ins.

## Repairs

Unfortunately, few dialogues will go as smoothly as the "[Perfect-World Dialogue](#)" in Appendix A. The StoryTime interface must be able to recover from misheard keywords, excessive background noise, and other problems that may arise during a typical conversation with a user.

### *Ambiguous User Responses*

Some users will respond to a yes/no question with indifference, for instance, "mmm" or "eh." These sounds can be interpreted as a positive or negative response, depending on context. As a result, StoryTime attempts to obtain a yes, no, or synonym from the user by prompting the user to confirm the action explicitly:

StoryTime I have a story about Spot the Dog and his red ball. Would you like to hear it?

User mmm.

StoryTime I'm sorry, I couldn't hear you. Do you want to read this story? Say "yes" or "no."

User Yes.

StoryTime Okay, <displays story> Do you want me to read it to you?

User Yes.

In the event that the system cannot obtain a "yes" or "no" from the user, StoryTime defaults to yes and displays the story. Barge-in functionality enables the user to interrupt StoryTime at any time, so if the interface's actions are not pleasing to the user, he or she can stop the system and StoryTime will begin a new query.

### *Out of Scope Vocabulary and Responses*

During the review process, a concern arose about getting proper feedback from a young user group. While the initial query for a story subject is wide open, subsequent questions require a yes/no answer from the user, reducing the possibility of misheard requests.

When an exchange exceeds the expected responses from the user, the StoryTime system attempts to return the user to the current task:

StoryTime What kind of story would you like to read?

User Jimmy told me today about this truck on his street. It was really noisy, and the driver...blah, blah, blah...

StoryTime That's really interesting. What kind of story would you like to hear today?

The system acknowledges the user's anecdote and then gently steers him or her back to the task at hand. If this tactic fails, StoryTime proceeds to the next level of repair.

### *When All Else Fails*

If StoryTime cannot obtain an acceptable answer from the user, there are a number of options that the system can choose from:

Problem	Solution
Unable to determine story subject	(a) provide option to go to "Today's Special Story" (b) choose two random stories and give the user a choice between the two (b) display index of stories with thumbnails and ask the user to click the story he or she wants
Unable to confirm a choice of story when a search is complete.	Choose a random story from the search list and start reading it. Rely on user to barge-in if the story is displeasing.
Long pause after a story or the interface's dialogue	Prompt for a user reply. If there is no answer, StoryTime goes into sleep mode and reduces animation

In the worst-case scenario, StoryTime assumes that there is an issue with the transfer of data between the user's computer and the server, and forces a mode switch to a standard web interface. A message box appears (since StoryTime can no longer assume that language is being communicated to or from the user) indicating that "StoryTime is experiencing technical difficulties." A list of stories with thumbnails appears, and the user must resort to using the mouse and keyboard to navigate the site.

## *Possible Directions for the Future*

Adding a Natural Language Interface to a children's website is a logical and beneficial improvement to the standard, graphic-based interface. It enables easier access to the content of a site for the 3 to 8 year old demographic. However, further improvements can be made to the interface through the addition of extra functionality.

Eventually, the StoryTime system could be ported to a portable storybook system.<sup>7</sup> The portable storybook system would be more flexible and convenient than the website, since the user could use it anywhere without an Internet connection, or even with a wireless Internet connection. Additional stories could be downloaded from the StoryTime site, for a nominal fee, similar to the way that additional Fido tones are purchased for cell phones.<sup>8</sup>

To increase StoryTime's value as a teaching aid, the Natural Language Interface could be used to give feedback to children reading aloud. The additional functionality could include assistance with pronunciation, correction, and explanations.

These features add improved accessibility to stories and increase the overall educational value of the system.

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<sup>7</sup> An idea discussed in Neal Stephenson's speculative fiction work, *The Diamond Age*.

<sup>8</sup> <http://www.fido.ca/>

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## *Glossary*

Anthropomorphism—the attribution of human characteristics on a God, animal, or thing. (Barber 52)

Natural Language Interface (NLI)—a user interface that integrates, or is controlled by, language.

Multi-modal Interface—an interface that incorporates more than one method of input from a user. For instance, a multi-modal interface uses a combination of voice, keyboard, mouse, and/or touch pad technologies.

## Appendix A: Perfect-World Dialogue

StoryTime <character appears> Hello. I'm StoryTime. I'm here to help you find a story to read. What kind of story would you like to hear today?

User I wanna hear a story about gophers.

StoryTime I have two stories about gophers. One is about Gopher and Winnie the Pooh. Would you like to hear that story?

User No.

StoryTime Okay, the other story is about a gopher and a tree. Would you like to hear that story?

User Okay.

StoryTime <displays story> Would you like me to read this story to you?

User Yes, please.

StoryTime (or pre-recorded narrator) Once upon a time...the end.  
Would you like to hear another story?

User Yes, about a bunny.

StoryTime You've heard a story about a bunny before. <reads short description>  
Would you like to hear it again?

User Yes.

StoryTime (or pre-recorded narrator) Once upon a time...the end.  
Would you like to hear another story?

User No.

StoryTime Okay. I'll see you soon. Don't forget to close the browser when you leave. <character vanishes>

## Appendix B: You're Speaking Martian Dialogue

StoryTime Hello. I'm StoryTime. I'm here to help you find a story to read. What kind of story would you like to hear today?

User I heard a story about this fire engine with a big dog and lots of flames once. It was really cool.

StoryTime I have a story about Cinder the firedog, would you like to hear this story?

User No.

StoryTime Okay, what other kind of story would you like to hear?

User <Mumbles>

StoryTime I'm sorry. I didn't catch that. Could you tell me again what kind of story you want to hear?

User Jimmy told me today about this truck on his street. It was really noisy, and the driver...blah, blah, blah...

StoryTime That's really interesting. What kind of story would you like to hear today?

User I donno.

StoryTime Today's special story is about the Peach Boy. Would you like to read that story?

User I guess

StoryTime Yes?

User Yeah.

StoryTime Okay. <displays story> Would you like me to read this story to you?

User No, I want to read it myself.

StoryTime Good for you! When you're done reading the story, just call my name and I'll help you some more.

User <reads story> Robot?

StoryTime Did you call me?

User Yes.

StoryTime Would you like to read another story?

User Yes.

StoryTime What kind of story would you like?

User I want a story about Pingu

StoryTime I don't have any stories about Pingu, but I have a story about a penguin named Fred. Would you like to read that instead?

User No. I want to read a story about a robot. Robots are way cooler. I have a red robot and it can fly and it...blah, blah, blah...

StoryTime Wow! That's exciting. Would you like to read another story today?

User No.

StoryTime Okay. I'll see you soon. Don't forget to close the browser when you leave. <character vanishes>

User But I want a story about a robot.

StoryTime <reappears> Okay, how about this one? <reads short description>

User No.

StoryTime What about this one? <reads short description>

User No.

StoryTime I'm going to show you a list of stories. Use your mouse to click the story you want to read. <page changes to show a list of stories with thumbnails for each, based on the book cover art>

User <selects a story>

StoryTime Would you like to read that by yourself?

User No, I want you to read it to me.

StoryTime Okay. One day there was...the end.  
Do you want to read another story?

User No, I'm done.

StoryTime Okay. I'll see you soon. Don't forget to close the browser when you leave. <character vanishes>