1a) Intended Users:

Our target users are children ages 3-5 years old, non-readers and beginning readers. The intended setting can be at home or in school. The program can be used independently, with a peer, or with an adult.

1b) what they'll be achieving:

Our interface offers children an experience that they cannot necessarily repeat in classrooms or at home. We intend for the user to learn the association of colors by how a color looks, how it sounds, and how it is spelled. Colors are used and referred to in many contexts -- in speech, in text, and in drawings. We want to strengthen the associations the user has or is developing among these three areas.

2. Inspirations

We were inspired by the children’s software “Thinkin’ Things, Collection 1,” from Edmark. The package includes several edutainment titles for children including a drumming orangutan named Oranga Banga. This game has three modes, varying from didactic to creative/constructivist. Oranga interacts with the user, helping to teach him/her to recognize different musical sounds. In the first mode, Oranga will play a series of instruments, and the user must repeat back, in order, the instruments Oranga played. After the user has become familiar with the different instruments, he/she can change the difficulty level, making the game harder by having Oranga play in the dark. When Oranga plays in the dark, the user has to discriminate the instruments just using the
auditory capabilities. Oranga Banga also includes a second mode that allows the user to free-play, just making sounds as he/she pleases. When designing Five Little Monkeys, we incorporated the features of allowing both free-play and repetition. While we are not trying to teach musical skills, we also used music in Five Little Monkeys as a reward system that is also skill-building and engaging.

The title *Five Little Monkeys* comes from a children's song with the same title. The interface is designed around incorporating the song, which helps to maintain the child's interest.

3a Design priorities

The principles of subjective satisfaction and learnability were our two greatest priorities. Subjective satisfaction is an important part of designing software for children. Often, they simply refuse to use software if they do not find it satisfying. While our interface was designed to be educational, it could not achieve this goal if the target audience did not want to use it. We wanted to maintain the users’ interests and ensure that the user has an entertaining and engaging experience. We tried to adhere to this principle by using animated monkeys that dance around and by using music. These simple features create an environment that maintains children’s interest.

Learnability was another important aspect of our design. Our design is supposed to be an educational experience, not a tool for accomplishing tasks quickly. At the start of the program, we guide the user to press any dancing monkey. This feature enables quick learning of the interface, which is continued by the monkey speaking. To further enhance learnability, we followed other design principles such as clear affordances, simplicity (less is more), and making error messages both
non-serious and clearly informative. Each of these principles is a key part of helping users quickly learn the interface and promote success. We minimized the number of buttons as well as making them clearly defined and animated to attract attention. We also adhered to Fitt’s Law, paying attention to button size and spacing. In addition, when designing these buttons we considered the lack of fine motor skill our target audience possesses which encouraged us to make the buttons large enough.

Our feedback and error messages help assist the user in making the correct choice. Rather than just stating, “you are wrong,” we scaffold the user’s learning by assisting him/her in small increments until he/she makes the right choice. After the first wrong answer, the text changes to the color it represents, so the word “blue” will actually turn blue. After more mistakes, we begin eliminating choices, until the correct selection is made.

4 Interesting features

Most of the standard interfaces we use are developed to help users accomplish their desired tasks quickly and efficiently. Our interface is focused on providing an experience to a specific user group and includes features like the animated monkeys playing songs. Not only does the monkey dance, but it responds to and interacts with the user, attempting to build a relationship. This is far different from the usual interfaces adults deal with today. Additionally, we have different modes of interaction – the monkey can either request to be dressed, or the user can decide to dress the monkey however he/she wishes.
5 User testing

Session 1-

<table>
<thead>
<tr>
<th>Finding</th>
<th>Solution</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>initial actions unclear</td>
<td>1) animate monkeys to attract attention</td>
<td>Yes, yes, yes</td>
</tr>
<tr>
<td></td>
<td>2) combined the bed and monkey button into one.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3) made other buttons invisible</td>
<td></td>
</tr>
<tr>
<td>color prompts distracting</td>
<td>1) Change initial color to white</td>
<td>1) yes</td>
</tr>
<tr>
<td></td>
<td>2) Include the song.</td>
<td>2) for testing we sang it ourselves with the users.</td>
</tr>
<tr>
<td>side panels confusing</td>
<td>Moved them next to the clothing</td>
<td>yes</td>
</tr>
<tr>
<td>difficulty levels currently unchanging</td>
<td>1) Let parents set the difficulty</td>
<td>No… suggestion for future</td>
</tr>
<tr>
<td></td>
<td>2) Have the computer adapt to the user’s progress.</td>
<td></td>
</tr>
</tbody>
</table>

**Details:** Our first group consisted of two girls, one who had just turned four, and the other was almost three. The four year old had begun to recognize different letters, but was primarily limited to uppercase ones. The three year old had not yet started to read or recognize
different letters. Both were asked to play the game (our interface) as we observed them. The four year old went through the whole interaction (dressing five different monkeys) a number of times, and seemed to thoroughly enjoy the game, as she continually requested to be allowed to play again.

The first problem we noticed was that both users had difficulty determining where to originally click. The interface at the start had several different items (see Appendix) on it and she was not sure what to do. She eventually discovered she should click on the monkey at the top, but we realized that we needed to make the design clearer. We decided to accomplish this by animating the monkeys so that they would attract the attention of the user. Another solution we later implemented was making the rest of interface invisible, so that the monkeys are the only options.

Another issue was that our feedback would occasionally confuse them. After clicking on the wrong piece of clothing on the right side of the screen, we had the name of the color drawn in that color pop up on the left side of the screen. This would make the four year old think that she should then click on that same color again, thus eliciting another wrong response. We fixed this by moving the response statements directly next to the piece of clothing they corresponded to. This makes it much easier to associate the response with the action.

When comparing the results between the four year old and the three year old, we recognized the need to adjust the difficulty of the game. This could either be adjustable by the parents, which is what the girls’ mother suggested, or could adapt to the success rate of the child. We did not have time to implement either of these, but we would like to
let the parent initially set the difficulty level and then have the interface adapt. We could make the game harder by not saying the words, adding additional colors, types of clothing, and different patterned clothing. We could also make the game easier, by having the words originally displayed in the color they represent rather than in white, which is our default color. This would allow the interface to grow with the user, and be more successful over a longer period of time.

During the testing we had the prompt originally show up in all yellow, and after they answered incorrectly, the statement would change to the color of the shirt. This confused the users, because they began to expect the color to be yellow, but there was no yellow shirt. We fixed this by changing the initial color to white, so it would be more neutral.

Session 2- **Major findings:**

<table>
<thead>
<tr>
<th>Finding</th>
<th>Solution</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singing works</td>
<td>Keep it</td>
<td>link audio with text...in future</td>
</tr>
<tr>
<td>Creative mode is desired</td>
<td>Incorporate this feature</td>
<td>yes</td>
</tr>
<tr>
<td>Hard to find the cursor</td>
<td>Make the cursor larger and possibly colorful</td>
<td>In the future, implement.</td>
</tr>
</tbody>
</table>

**Details:** Based on our findings from the first stage of testing, we had the monkeys talk and sing. This was not operational by the computer but we the testers sang and read the prompt as it appeared on screen and as the monkey was dressed. The users were very motivated by this and would sing along. If fact, at one point we stalled a little in singing after a monkey was dressed and one of the users prompted us by singing herself.
Also, we used the results of the pre-test to scaffold the learner. In this way, we adapted to the user’s prior knowledge. We found out the 5 year old could read the color words, so we pointed to the color word to have her sight-recall it. This was different from the scaffolding we provided to the 3 year old who did not recognize any of the letters but did recognize the colors. She relied solely on the audio. These users reported to us that they enjoyed dressing the monkeys. They all liked being told how to dress them. One of them said she might like to choose the monkey’s clothes he/she would wear in “free-play.”

In future iterations of Five Little Monkeys, we recommend having 3 modes (create, teach, and weather) to satisfy the needs of our users. The weather mode would have the user respond to outside, variable temperature and select appropriate clothes for the monkey, dependent on the weather.

6 Educational goals

Our program targets users who are acquiring pre-reading, reading skills. Some of these skills are tracking of text and left to right display of text. The feature that permits this is not yet implemented in our prototype although we would like to implement it in future versions. As the monkey speaks a word, that word is displayed on the screen in real time, from left to right. The user will see this over and over again which will expose him/her to the directionality of text in written language. Beginning readers, children ages 3-5, often need a pointer or finger to keep place reading.\(^1\) Having the words appear one by one will help these children keep place.

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By having the monkey say the color before saying the object we are exposing the users to the adjective-noun pattern in English. This exposure and repetition is particularly useful to non-native English speakers whose language has a different adjective-noun placement. Our program features “teach” mode that helps develops listening skills. In this mode, the monkey tells the user what he/she would like to wear. The text is also printed below the dancing monkey, which exposes students to text and makes a relationship between the written words, the spoken words, and the displayed objects. In this way, the user is able to visualize this relationship—words are not in isolation.

We also hope for students to develop some sight vocabulary--words that a student can recognize without actually phonetically sounding out each letter. Sight vocabulary, in this case, colors and the clothes, is important for pre-readers and readers.

Our program allows users to practice using fine motor skills of maneuvering a mouse and finding the target. Fine-motor skill development is particularly useful for writing. Maneuvering the mouse towards a target also helps them develop eye-hand coordination.

7 Pedagogical methods

We incorporate several aspects of the Behaviorist theory of learning and knowing in our program Five Little Monkeys such as stimulus response, extrinsic incentives, and compilation of acquired skills and information through routine and practice.

Our program Five Little Monkeys allows the user to associate a stimulus with a response. For example, when the user is prompted to respond to the stimulus of the monkey’s verbal and written request. The
child gets positive feedback in the form of animation, song, and congratulatory messages. These are examples of extrinsic incentives. Once the monkey is dressed, the monkey dances. Then, the monkey leaves the room and the user selects another monkey to repeat the process. Each monkey prompts the user to select a random pairing of clothes and colors. As the user selects the monkey, another extrinsic incentive of music is available to the user.

Also, it has been found that students learn more effectively from individualized instruction than from classroom instruction. Also, it has been found that students learn more effectively from individualized instruction than from classroom instruction. This individualized instruction can be in the form of computer programs that teach routine skills in mathematics, reading and vocabulary. Five Little Monkeys offers the user this type of individualized instruction.

A user is motivated to dress five monkeys. He/she is engaged by interacting with the jumping monkeys and the song that plays after one is dressed. Extensive, repetitive practice allows the user to build his/her skills. The incentives are different after each cycle because the music selection corresponds to the number of monkeys left. Also research shows students’ experiences of pleasure and satisfaction or embarrassment and humiliation are likely to shape student’s future affective responses to the situations of school learning. This was a big motivation in our design of Five Little Monkeys. We wanted to provide students with an engaging pre-reading experience that inspires, rather than scares, them to read.

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We also incorporate some aspects of the **cognitive theory** such as active construction of knowledge and scaffolding of learning. First, we allow the user to be active by using direct manipulation. He/she can actively construct his/her understanding of what words represent. This is in accordance with Piaget’s constructivist theory that “individuals do not absorb or copy ideas from the external world, but rather must construct their concepts through active observation and experimentation.”  

This knowledge construction is especially true in the create mode where the user self-selects the clothing the monkey will wear. In this way, the user guides the program. When the user presses a blue shirt, the monkey wears a shirt that is blue and the monkey says, “Now I’m wearing a blue shirt” and the corresponding text appears.

Second, we scaffold the user’s learning through visual elimination, oral directions, and color-coded words. Our program is accessible to auditory, kinesthetic, and visual learners—another type of scaffolding. A learner may use more than one modality when he/she learns and our programs supports this. He/she often uses a combination of modalities: visual-- user will see the words of the colors on the screen and how the color looks applied; auditory-- user will hear the word being said; and kinesthetic-- user will learn by doing. We plan for the computer to increase the difficulty level based on what a student knows. This is based on the student’s prior knowledge and experience, another cognitive aspect that knowledge continues to build. For example, a student who does not distinguish a shirt from a pair of pants can be aided with a visual representation of a shirt. On the other hand, a student who already distinguishes between these will not be given clues.

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Using Java to construct our prototype, we did not have any problems implementing our exact basic design. Overall we were able to achieve all the desired features for the prototype. The ability of Java’s swing components to interact with the user (respond to clicks) made it particularly easy to design the program. Sounds proved to be a tougher issue than previously thought. Using the capabilities of Applet class did not work. We also tried using Java1.3 sound capabilities but the JVM for Mac is only updated through Java 1.2.2, so this did not work either since our output device was a Mac.

Because our prototypes were nearly complete, our user testing proved that our program was an engaging experience. In order for learning to take place, the user needs to be engaged. Research tells us that this user group has short attention spans which we accommodate by having the sequence of five monkeys. This engages the user. The actual amount of learning taking place during our program could later be measured more extensively.
9. Appendices:
A. Lyrics of song:

**Five Little Monkey's Jumping on the Bed**

Five little monkeys jumping on the bed,  
One fell off and bumped his head.  
Mama called the Doctor and the Doctor said,  
"No more monkeys jumping on the bed!"

Four little monkeys jumping on the bed,  
One fell off and bumped her head.  
Papa called the Doctor and the Doctor said,  
"No more monkeys jumping on the bed!"

Three little monkeys jumping on the bed,  
One fell off and bumped his head.  
Mama called the Doctor and the Doctor said,  
"No more monkeys jumping on the bed!"

Two little monkeys jumping on the bed,  
One fell off and bumped her head.  
Papa called the Doctor and the Doctor said,  
"No more monkeys jumping on the bed!"

One little monkey jumping on the bed,  
He fell off and bumped his head.  
Mama called the Doctor and the Doctor said,  
"Put those monkeys straight to bed!"
B. Interface History

Sample interface layout of “Five Little Monkeys” just a mock-up 11-15-01

11-24 opening screen programmed in Java. + no overlap; Game starts when user clicks on a monkey or bed.

12-5 Opening screen. + Now it’s very clear what to press (any of the dancing monkeys).

11-24 game play + positive feedback. – Lots of text in different parts of the screen.
12-5 Screen during game play
Different requests to the player. Note the left-side message and the right-side one.

+ bottom message; feedback of visual elimination and Wrong! in blue color.

12-5 Help (also controlled by bottom Help)

12-5 Modes of teach, create, and weather.
C. User Study

**Five Little Monkeys User Study**  Angie, Matt, Joe, Nina

**Users:** ages 2.5-5 year olds, non-readers and beginning readers

**Setting:** User’s home

**Question:** (should be something we don't know the answer yet...)
- Is our interface appealing and understandable to our target user?
- Does the user interact with the monkey?

**Method:**
1) **Instructions**: Tell users that they will play a game with 5 Little Monkeys.
   “Do you want to play a game that we made?”
   • Do parts 1 and 2 separately.
   • Ask “Are you ready?”
   Part 1: Say: “You will need to listen carefully to the monkey. The monkey will let them know how to dress him.”
   Part 2: Say: Now, you’ll get to dress the monkey however you want.
2) User will work individually at the computer. Assistance can be provided to overcome interface problems.
3) • As user proceeds with the game, note which buttons they choose.
   • Observe whether user waits for feedback or just keeps hitting buttons.
   • Ask questions such as “Why did you choose the blue shirt?” Record responses.

2) **Pretest:**
   **Colors:** Present color swatches and ask children to tell you what color it represents. (Or show me “blue.”)
   **Reading:** Present hand-written words of the color words in black text (blue, green, red)
3) After test discussion with users and parents:

   **Ask:** What were you trying to do?
   What was the most fun?
   What was hard for you to do?
Observation Notes of 5 Little Monkeys User Study:

User: b g age:
computer experience: reading ability:
Observer:

Pretest:
+ = recognizes quickly
√ = recognizes with hesitation
0 = does not recognize

Colors: Blue yellow red green orange

Reading: Blue yellow red green orange

Actions:

Emotions: (laughing, crying, etc.)

Questions asked:

Body language:

Discussion Questions after:
What were you trying to do?

Did you like the monkey?

What was the most fun?

What was hard for you to do?

With parent(s):
Any recommendations to make this more user friendly?