

Usability Testing of Accessible Lemonade Stand

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Overview

- Introduction
 - Accessibility in game design: market benefits and legal requirements
 - Limited resources for accessibility, both tools and guidelines
- Goals
 - Usability testing of audio math game
 - Design recommendations
 - Generalized design guidelines
- Current prototype
- Methods
 - Participants
 - Assessments
 - Meetings
- Results
 - Usability and assessments
 - Design recommendations
 - Design guidelines
- Discussion
 - Conclusions
 - Future Directions
- Thank You & Questions

Introduction

- Terms
 - Lemonade Stand
 - Games – digital; on a console, computer, phone, tablet
 - Accessibility – technology and disabilities
 - Emergent design and behavior – facilitates further/outside engagement

Introduction

- Accessibility in Games
 - 20% compared to 15% of population
 - 26% below 18, 27% above 50
 - 32% users of accessibility features – no disability
 - 97% of children play 1+ hours a day
 - Precedence in AAA and independent games in variety of genres, platforms

Introduction

- Limited Resources
 - Tools native to popular engines
 - Digital distribution platforms
 - Concrete guidelines (Game Accessibility Guidelines, Includification)
- Legal Needs
 - Increase in indie, educational, serious games
 - National and international standards
 - MOOC lawsuits

Goals

- Working with Accessible Lemonade Stand
 - Usability testing
 - Create design recommendations
 - Generalized design guidelines

Current
Prototype

Yum! Lemonade Stand
Press ENTER to play

Current
Prototype

Day 1 Player 1: \$25.00

How many cups would
you like to brew?
(\$0.25/cup)

Press ENTER to choose how many signs to make

Current
Prototype

Review of Day 1 Player 1

Number of cups 1

Number of 1

Press ENTER to skip the current line

Methods

- Participants
 - 7 students between 3rd and 7th grade
 - 4 male, 3 female
 - 4 blind, 3 visually impaired
- Analysis
 - Predominantly qualitative – averages, SD's

Methods

- Assessments
 - Demographics and Current Technology Usage
 - Technology Self-Efficacy - Meeting 1, Meeting 3
 - Usability - Single Player, Multiplayer
 - User Satisfaction - Single Player, Multiplayer
 - Emergent Behavior
 - Timed Task - full game, controls, intro, radio show, customers
- Meetings
 - Meeting 1 – single player
 - Meeting 2 – multiplayer
 - Meeting 3 – debrief

Results

- Timed tasks

Controls	Introduction	Radio Show	Customers	Full Game
50.6 seconds	78.75 seconds	65.32 seconds	41 seconds	32 minutes 4.76 seconds

- Usability

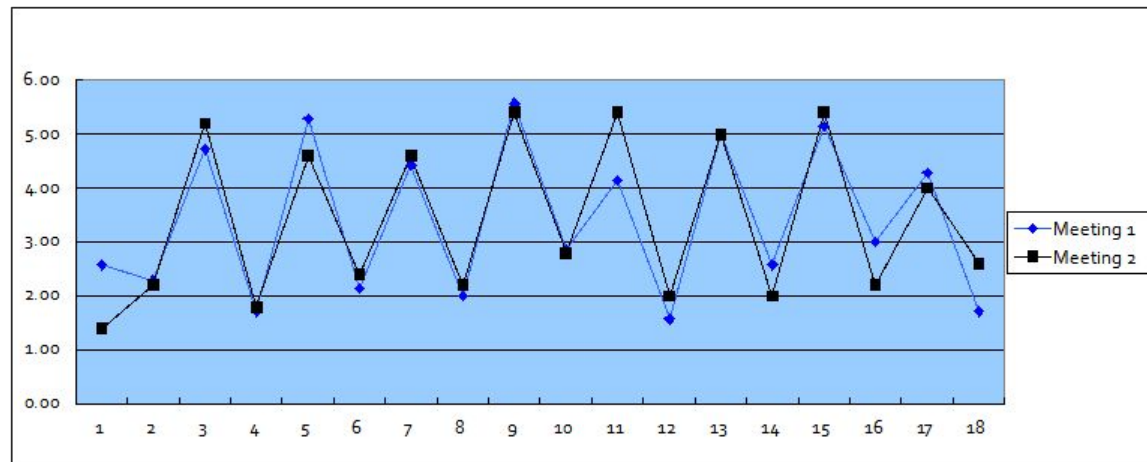
Question	Single	Multi
3. Able to access in-game help to answer questions on their own.	FALSE	TRUE
8. Able to read in-game text if they wanted to.	FALSE	TRUE
13. Understood how to play game to completion in two rounds.	FALSE	TRUE
26. Could backtrack and change input in the intended field.	FALSE	TRUE

Results

•User Satisfaction

Question	Single	Multi
1. Overall, how much did you enjoy the game?	Enjoyed	Enjoyed a lot
2. Compared to other electronic math games you have played, is it better, the same, or worse than other electronic math games?	About same	Better than
3. Based on playing this game, would you want to play this game again?	Probably	Probably
4. Based on your experience with this game, would you recommend it to a friend?	Maybe	Probably

•Technology Self-Efficacy



Results

•Emergent Behavior

Question	Third
4. I have wanted to play the game with a friend while at home or at school.	TRUE
12. I want to know how the game was made.	TRUE
13. I have compared strategies to get a higher score with someone else.	TRUE
19. I want to find more electronic math games after playing this.	TRUE

•Demographics and Current Technology Usage

Question	First
6. How much difficulty do you have in carrying out your school work?	Moderate
7. How often do you use a computer?	Frequently
9. How often do you use a tablet with internet, electronic games, and apps?	Frequently
11. How often do you play electronic games, like games on a computer or console?	Frequently

Results

- Open-Ended Demographics and Current Technology Usage
 - 5 students had someone help them play games
 - 2 played Minecraft, 1 Angry Birds, 1 Call of Duty, 2 Mario Kart, 1 Little Big Planet, 1 Grand Theft Auto V, 1Blindfold Racer, Brainpop
 - All 7 played educational games at school, 6 play games at home
- Comments/Observations

Negative comments/observations	#
• Specify needing decimal, limit the price of lemonade	3
• Shorten audio segments (introduction, radio show, buyer feedback)	4
• Unable to use number pad	7
• Wanted to change size of screen and text	3

Positive comments/observations	#
• Worked collaboratively	4
• Wanted to do mental math or use a calculator	2
• Students who were blind/visually impaired stated they could play with little help	4
• Expressed interest in math, how the game was made, game development.	6

Design Recommendation s

Timing

- Display text sentence-by-sentence
 - Ensure whole session of the game (single player, 7 days) takes less than 20 minutes
 - Put controls in introduction, display simultaneously, take less than 30 seconds
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Accessibility

- Game can be full screen, number pad is usable
 - Have "options" that allow player to change color scheme for contrast, color-blindness
 - Automatically clear field if player tries to spend too much
 - Specifically instruct players about using cents
 - Make sure all vocabulary would make sense at a 2nd or 3rd grade reading level.
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Game Features

- Have weather information given at start of radio show and planning costs for the day
 - Customers should give actionable feedback about costs, weather, amount made
 - Give running totals after each purchase (cups made, signs made)
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Design Guidelines

Visual Impairment

- Keyboard controls do not interfere with existing accessibility features. (IBM)
 - If spoken input is used, ensure input can be both manual and spoken.
 - Provide an option to display a visual cue for all audio alerts. (IBM)
 - Inherit system settings for font, size, and color for all user interface controls. (IBM)
 - Test with players with different forms of visual impairments. May not only have trouble with vision, but may perceptually and spatially conceive of your game differently.
 - Should work with other applications open, especially accessibility aids. (Microsoft)
 - Allow for magnification. (Microsoft)
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Design Guidelines

Children

- Ability to freely navigate game with minimal help needed or errors. (Intel)
 - Have large targets that are not near hardware buttons (back buttons on phones, tablets). (Intel)
 - Limit attention needed to understand controls, premise of the game, and critical information for playing the game successfully.
 - Assess children both individually and in groups.
 - Limit length of time needed for one session of the game - is it appropriate for school? A car ride? Playing at home?
 - Explain concepts that may be a "given" to adults: use a period for cents, typing rules for grammar, etc.
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Discussion

- Conclusions
 - Increase in ratings after multiple sessions
 - Usability problems
 - Universal design to improve accessibility
 - Sense of independence
- Future Directions
 - Assess with more students
 - Implement design recommendations
 - Explore usage with a curriculum

Thank You & Questions

- Thank You!
 - Dr. Bruce Walker
 - Dr. Carrie Bruce
 - Sonification Lab
 - Center for the Visually Impaired
- Questions?