Learning in the Living Room? 4-6 year olds and home interface design

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Why is the living room such a challenging interface environment?

- Ergonomic: Furnishings

Sofas, chairs, and low ‘coffee tables’ in highly diverse arrangements seem a poor match for many current input device designs

- Developmental: Device difficulty and the “10 foot problem”

Device difficulty: Some devices are harder for small children to use than others due to the cognitive demands their designs make on the user

“10 foot problem”: Compensating for differences between size of device movement and size of cursor movement onscreen

Research Goals

- **Evaluate devices as interfaces for young children in the living room performing two tasks:**

1. Moving onscreen objects from one place to another
2. Drawing simple lines and forms onscreen.

- **Assess devices on two levels:**

1. Their ergonomic fit with the living room given children's performance
2. Their ease of use in executing the above tasks in the living room context

Devices Tested

Xbox360 controller

Digipad

Wireless Mouse

Wii Remote

Interaction Screens

Object Movement: Move the bear next to the monkey; move the turtle far away from the other animals.

Simple drawing: Draw a circle around the bear; draw a line connecting the monkey to the tree.

Assessment Criteria

- Ergonomic
  - Posture
  - Grip
  - Control
- Performance
  - Need for Assistance
  - Level of success
  - Time on task

Participants

- 8 - 4 years olds: 4 girls, 4 boys
- 8 - 5 years olds: 4 girls, 4 boys
- 7 - 6 years olds: 3 girls, 4 boys

- All but 1 kid had Mouse experience.
- 12 kids with Xbox experience
- 4 kids with Wii experience
- No kids with Digipad experience

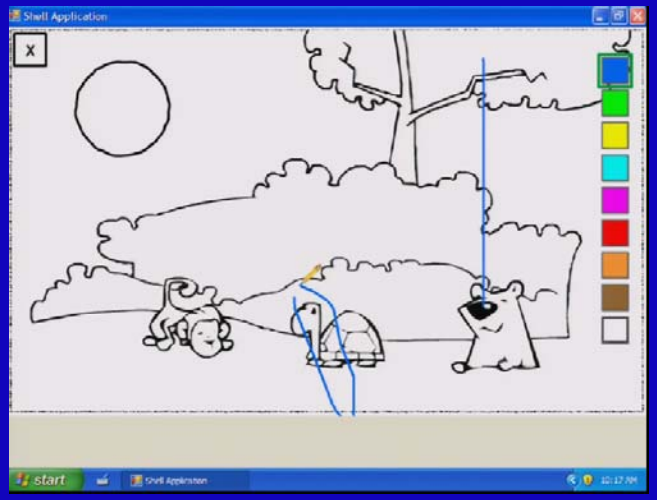
Methodology

- Children tested in room with sofa, low table, and big TV screen 10-12 ft. away (“living room”)

- All children used multiple devices
  - Devices presented in counter balanced order

- All task with all devices were executed *twice*

What are they doing physically?

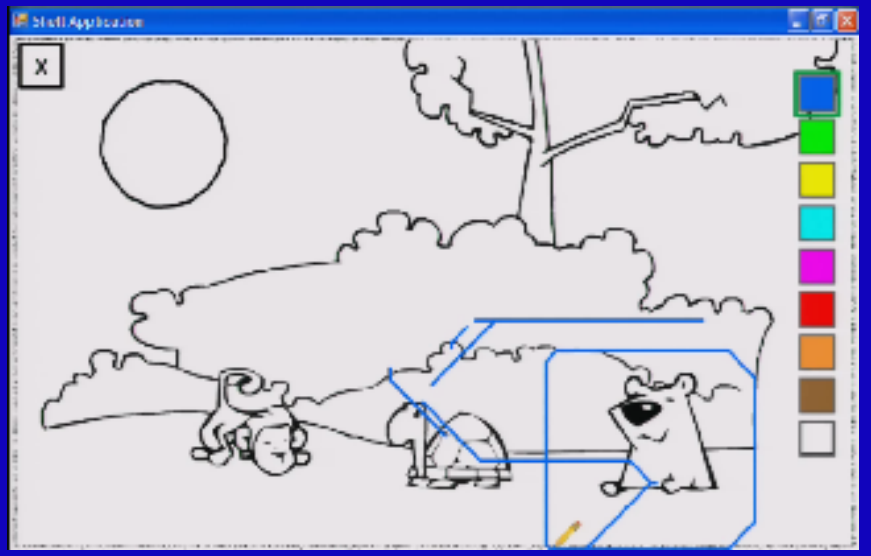


What is happening on the screen?

Xbox Controller

Xbox Performance

- Good performance for moving objects
- Slower than other devices for drawing
- Kids needed more assistance with xbox when drawing, relative to other devices
- Problems due to fixed cursor speed, rectilinear cursor motion with dpad
- Mixed ergonomic results: Body posture relaxed BUT kids must stretch fingers to reach, and apply excessive finger pressure to controls



P10 (5-year-old girl) using Xbox: Drawing a line from the turtle to the bear and then drawing a circle around the bear.

Kids with Xbox experience assumed a relaxed,
often nonchalant, body posture for the entire session.







Some used an excessive amount of force to draw with the dpad. For others the use of secondary controls (dpad and right thumb stick) resulted in awkward hand postures due to reaching.

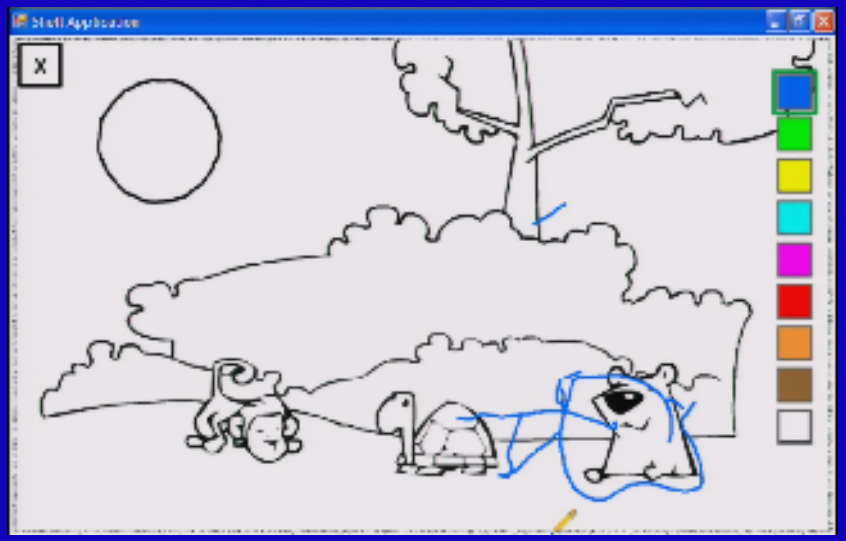
Excessive force to use dpad

Reach to 2ndary controls

Digipad

Digipad Performance

- Poor for object movement due to kids not being able to “hover,” or keep pen/pad pressure or stylus orientation consistent
- Good performance for simple drawing, but slow due to task demands
- 4 year-olds have significantly more difficulty but all children improve over trials
- Ergonomically, very good at the interface with pad and stylus but ill-suited to lap use, the likely LR scenario



P10 (5-year-old girl) using Digipad: Drawing a line from the turtle to the bear and then a circle around the bear. Note the extra lines where the stylus got too close while she was hovering during navigation.

Half of the 4-year-olds held the stylus in a “typical” grip style.




While the remaining 4-year-olds did not.







It was necessary to hold the stylus vertically, at an unnatural angle, to “click” and pick up objects. Ironically, this was easier for 4s than for the 5- and 6-year olds who have just mastered the standard pencil grip pencil and now practice it religiously.





Because the furniture kids sit on in the living room is not designed for their small size, using the digipad on your lap means a slanted drawing surface as you settle forward or backward on the cushion.




Placing legs straight out or on table in front to keep pad from slanting



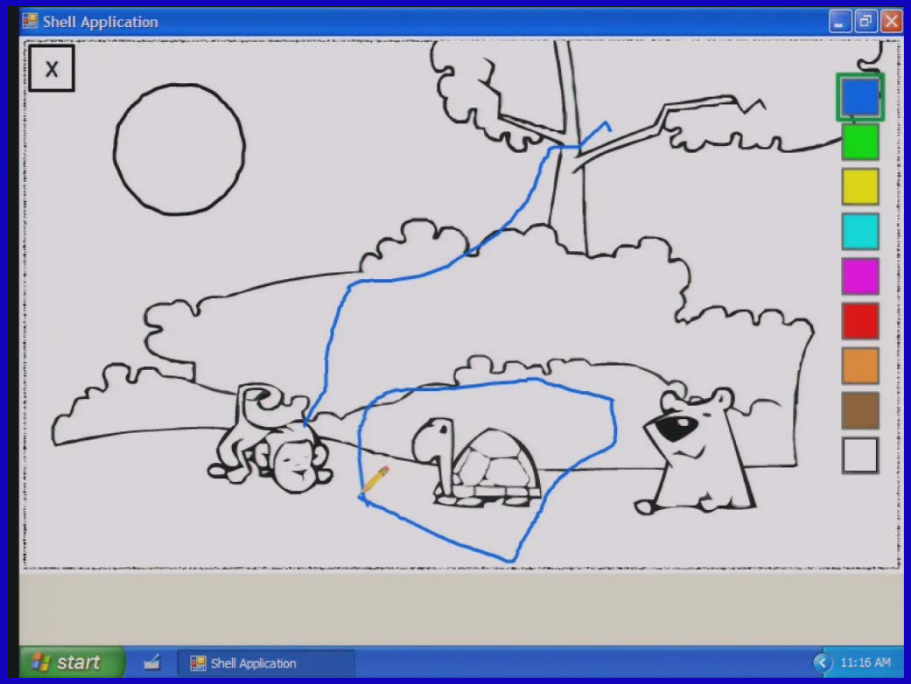


Sitting on edge of couch

Mouse

Mouse Performance

- Successful performance on both object-moving and drawing tasks.
- Living Room context forces young mouse users into ergonomically awkward hand and body postures



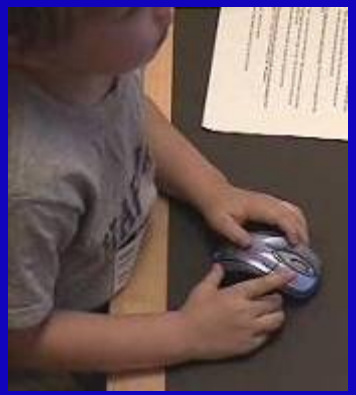
P06 (5-year-old boy) using mouse: Draw a line from the monkey to the tree; draw a circle around the turtle.

4-year-olds who primarily used the mouse with one hand.




4-year-olds who primarily used the mouse with both hands.





Note that the 4-year-olds typically had problems with accidentally pressing the right mouse button.

Several awkward hand postures were used by the kids in the living room environment.

Flexed finger on right button

Extended, hovering finger on right button

Ulnar deviation (wrist bent toward small finger)

Splayed index and middle fingers

Several awkward body postures were used by the kids in the living room environment to compensate for the lack an ideal mousing surface.





Standing or leaning on table results in wrist extension (wrist bent up)

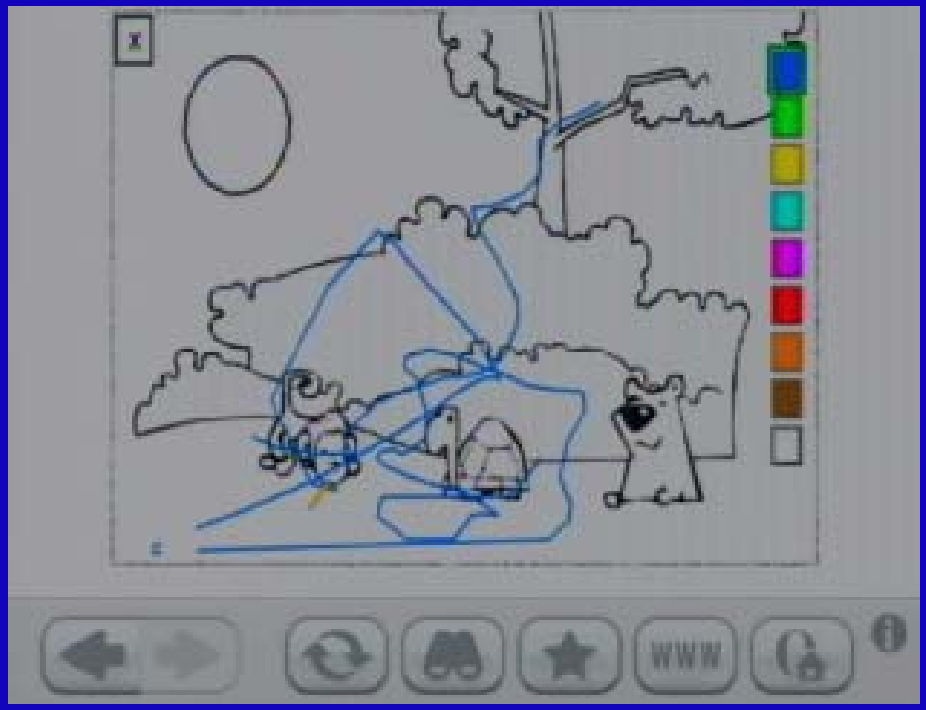
Sitting on couch, leaning forward to reach mouse

Shoulder abduction (away from body)

Wii Remote

Wii Performance

- Poor for all tasks: Highest failure rates and longest execution times for all tasks
- Kids needed help to move objects and had difficulty with simple drawing
- Problems due to interface's lack of fine motor control



P10 (5-year-old girl) using Wii: Drawing a line from the monkey to the tree and then a circle around the turtle. Both her line and her circle "meandered" around the screen.

All kids rested their arm(s) on their laps for stabilization.

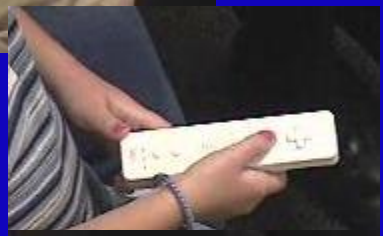
All 4 year olds held the controller with both hands

5- and 6 year-olds held the controller with both hands for more precise control during the session.











Several used the controller with their shoulders flexed forward, a posture that cannot be maintained over a period of time without resulting in discomfort.











As one 6-year-old commented, “It is hard to hold up.”

Results Summary for Devices Used in Living Room Environment

Assessment	Digipad	Mouse	Wii	Xbox
Object Moving	-	+	-	+
Line/Circle Drawing	+	+	-	-
Ergonomics / Ease of use at the interface	- / + + familiar: like drawing on paper – Fine motor demands of interface (“hovering” etc.) – Does not support lap use	-	-	- / + + Kids completed tasks at same level of success as mouse and digipad – needed the most help for simple drawing – execution of tasks was slowest of all successful interfaces
Ergonomics of body posture	+	-	-	+

No current device is appropriate for young children's Living Room use

- Ergonomics: Living room furnishings are mismatched to most interface designs, with bad ergonomic results for young kids
- The "10 foot problem:" Increases difficulty, but not as big a problem as theorized. Differences between devices were more substantial.
- Device differences: Children were most successful on the current tasks with the mouse and digipad interfaces, most comfortable ergonomically OVERALL with xbox and digipad.

Take away:

- A device that provides young users with a (wireless) lap-top drawable/mousable surface for interacting with the big screen seems best suited to the Living Room.