Designing New Technologies for Early Childhood: Initial studies of ScratchJr

SCRATCHJr

Learning in early childhood through programming

imagine * program * learn

Elizabeth R. Kazakoff & Professor Marina Umaschi Bers
Tufts University

Overview

ScratchJr is a graphical computer programming language designed for children ages five to seven by the DevTech Research Group at Tufts University, the Lifelong Kindergarten Group at MIT, and the Playful Invention Company. Our team partnered with local teachers, students, and school administrators to design the first ScratchJr prototype, based on the Scratch (scratch.mit.edu) computer programming language created for children ages eight and up.

The core philosophy of the ScratchJr project is that children in kindergarten through second grade, compared to children in older grades, have very limited options when it comes to powerful, developmentally appropriate, educational technologies – especially in terms of fine motor control, reading level, and self-regulation.

ScratchJr will include three key components:
1. A developmentally appropriate interface, with both touch screen and mouse options
2. Curriculum modules that meet federal and state standards for early childhood education
3. An on-line resource community for early childhood educators and parents.

Study Design

Phase 1	Fall 2011 – Spring 2012	Observation of 5-7 year olds using original Scratch
		Development of ScratchJr v1, evaluation methods, curriculum
Phase 2	Summer 2012	Pilot testing of ScratchJr v1, curriculum, data collection methods
	Fall 2012	Classroom implementation of ScratchJr v2, curriculum, data collection methods
		Assessment of three core areas: Foundational Knowledge, Discipline-Specific Knowledge, Problem-Solving Skills
	Spring 2013	Revision of curriculum and software
		Continued classroom implementation
		Comparison of Spring to Fall Curriculum
Phase 3	Fall 2013 – Spring 2014	Expansion to (up to) eight new classrooms
		Development of online community
Phase 4		2014 Public Release (expected)

ScratchJr Team
DevTech Research Group
Tufts University
Prof. Marina Umaschi Bers, Ph.D. (Co-P.I.)
Louise Flannery, M.A., *Research Scientist*
Elizabeth R. Kazakoff, M.Ed. *Graduate Research Assistant*

Lifelong Kindergarten
MIT Media Lab
Prof. Mitchel Resnick, Ph.D. (Co-P.I.)

Playful Invention Company
Paula Bontá
Brian Silverman

Contact
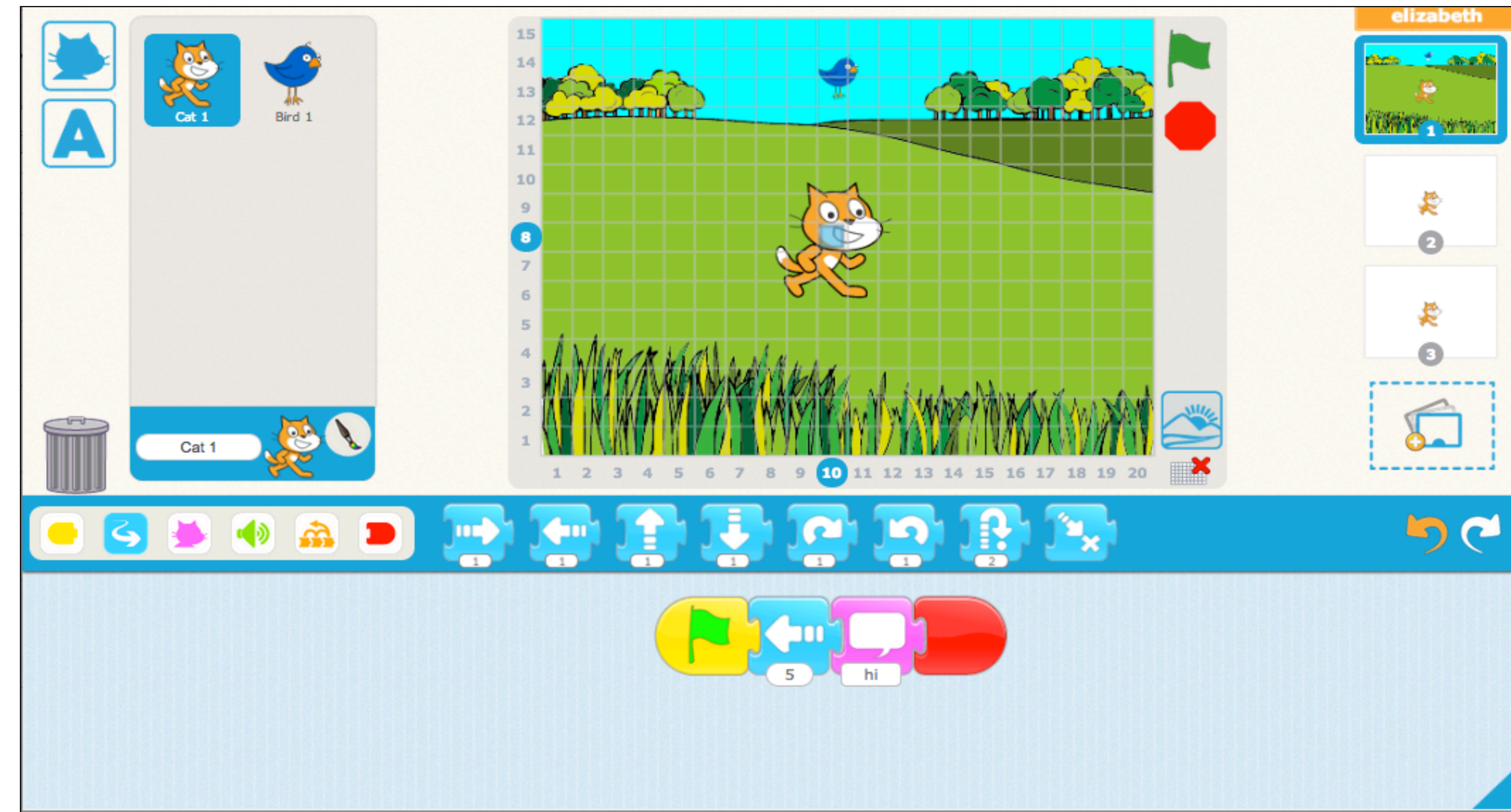@TuftsDevTech
ase.tufts.edu/devtech
devtech@tufts.edu

Figure 1. ScratchJr Screenshot

Design Considerations

Table 1. This chart outlines the major differences between Scratch and ScratchJr

Original Scratch	Rationale for Resign	ScratchJr
100+ blocks	Original number of blocks overwhelming and not necessary for an early childhood programming language	~ 30 Blocks
Lack of compound programming blocks	Easier to create meaningful narratives with fewer blocks	Compound programming blocks (e.g., Hop)
Blocks primarily word-based	More intuitive to use for children who do not yet read; maintain words for those who do read and assists with building vocabulary	Blocks primarily icon-based with words displayed on "hover"
Small programming blocks	Better fit with the motor skills of younger children (i.e., more surface area to target with mouse); also compatible with a variety of platforms (e.g., iPad)	Larger programming blocks
Characters are drawn free hand, selected from complex menus, or imported	Colors on characters can be easily changed to make characters more personally relevant (e.g., hair, eyes, skin, clothes); free draw is also an option	Easy fill characters
Growing/Shrinking can be accomplished without programming; Characters can be added by the 100s by clicking a "?" button	Children are developing their self-regulation skills, so we removed the instantly gratifying, "quick fix" buttons and turned them into programming blocks	Actions made by "quick fix" buttons are now programming blocks
N/A	Story pages exist for ease of making story books and building connections to early literacy	Story Pages
Coordinate System	A number-based graph overlays the screen for assisting in number sense and understanding how far the characters will travel	Grid (with on/off switch)
Unlimited Parameter Numbers	When the numbers were unlimited, young children tended to hit many number keys to make a large number. In ScratchJr, the numbers can be entered only up to where they have meaning relative to the space (e.g., maximum moving 20 spaces horizontal/15 spaces vertical)	Limited Parameter Numbers

Participants

Table 2. ScratchJr Sample by Project Phase

	Pre-Kindergarten	Kindergarten	Combined 1st/2nd Grade	Location	Gender	Dates Hours
Pilot 1. Original Scratch.	8	19	16	Private School	49% Female 51% Male	Fall 2011 5 hours
Pilot 2. ScratchJr Pilot Software Only Version	4	6	7	Private School	47% Female 53% Male	May 2012 1st/2nd - 4 hours K - 2 hours PK - 1.5 hours
Pilot 3. ScratchJr Pilot Software with Pilot Curriculum	-	2 (Entering)	3 (Entering)	In Lab	40% Female 60% Male	July 2012 10 hours
Full Study. Fall 2012. ScratchJr with Curriculum v1	-	18 Private 39 Public	19 Private	Public & Private Schools	51% Female 49% Male	October 2012 – December 2012 10 or 20 hour curriculum
Full Study. Spring 2013 ScratchJr with Curriculum v2	-	18 Private 18 Public	19 Private	Public & Private Schools	51% Female 49% Male	February 2013 – May 2013 10 hour curriculum
Full Study. Fall 2013 & Spring 2014 ScratchJr with optional curriculum and no research assistant intervention	-	TBD up to 8 classrooms		Public & Private Schools	-	September 2013 – May 2014 hours TBD

Assessment

Quantitative Data Collection
- sequencing (picture stories)
- self-regulation (HTKS & BRIEF)
- Math (TEMA-3)
- problem-solving (conservation tasks)

Qualitative Data Collection
- copies of computer programs
- audio/video screen capture of computer programming
- comparison of fall/spring curricula

References

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