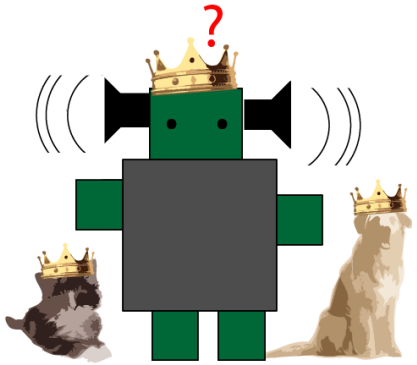

# HCIM Capstone Project

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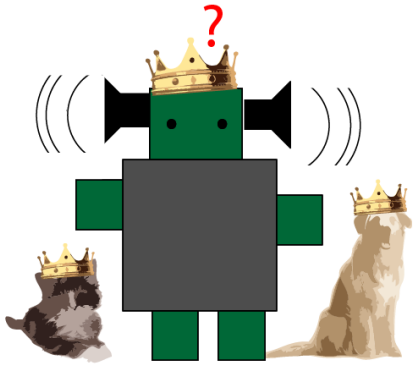
Mona Leigh Guha
Tamara Clegg

## Clinky the Robot:
## Preliminary Programming for Preschoolers

HCIL HUMAN COMPUTER INTERACTION LABORATORY

UNIVERSITY OF 18 56 MARYLAND

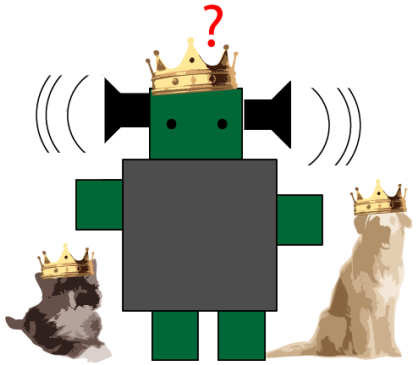
4/25/2013



# Clinky the Robot

## Problem

Young children are left out of consideration in Computer Science learning



# Clinky the Robot

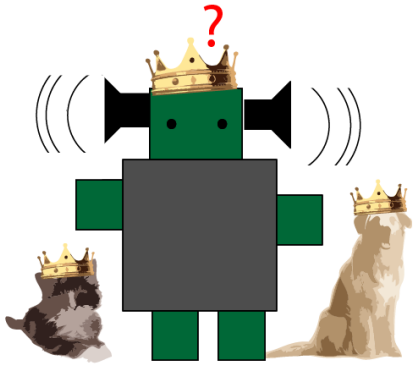
## Why is that a problem? (Motivation)

Harnessing the full potential of computers[1]

Debugging skills are beneficial to everyone[2, 3, 4]

Computer Science: Not the most diverse field[5, 6]


[1] D. C. Smith, A. Cypher and L. Tesler, "Programming by example: novice programming comes of age," Communications of the ACM, vol. 43, no. 3, pp. 75-81, 2000.
[2] A. Sipitakiat and N. Nusen, "Robo-Blocks: designing debugging abilities in a tangible programming system for early primary school children," in *Proceedings of IDC 12*, Bremen, Germany, 2012.
[3] L. Morgado, M. Cruz and K. Kahn, "Preschool Cookbook of Computer Programming Topics," *Australasian Journal of Educational Technology,* vol. 26, no. 3, 2010.
[4] P. Wyeth, "How Young Children Learn to Program with Sensor, Action, and Logic Blocks," *Journal of the Learning Sciences,* vol. 17, no. 4, pp. 517-550, 2008.
[5] A. Fisher and J. Margolis, "Unlocking the clubhouse: the Carnegie Mellon experience," *ACM SIGCSE Bulletin,* vol. 34, no. 2, pp. 79-83, 2002.
[6] A. Fisher and J. Margolis, "Unlocking the clubhouse: women in computing," in *Proceedings of SIGCSE 03*, Reno, NV, USA, 2003.



# Clinky the Robot

## Can they do it?

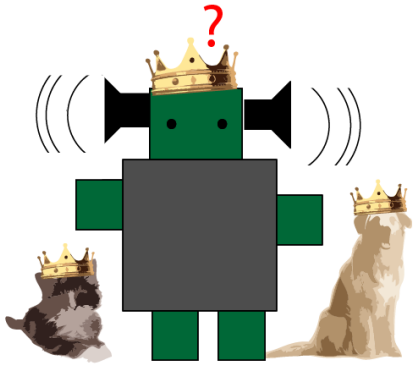
Comfortable with computers[1]

Independent in their exploration processes[2]

Developmentally Appropriate[3]

Children want to program[4]

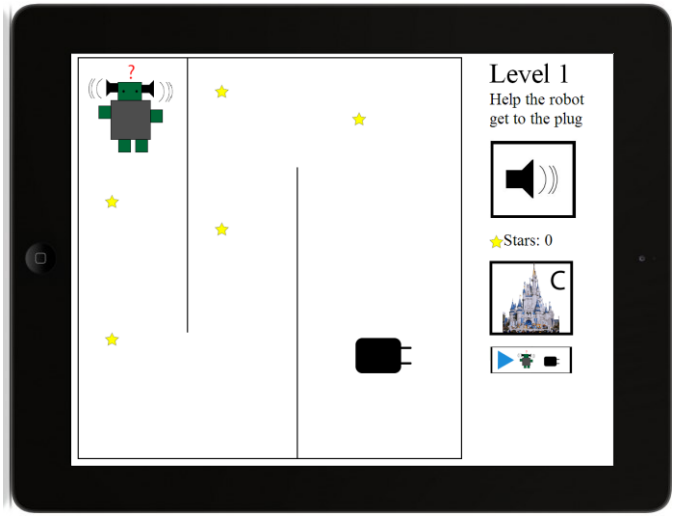

[1] L. Morgado, M. Cruz and K. Kahn, "Preschool Cookbook of Computer Programming Topics," *Australasian Journal of Educational Technology,* vol. 26, no. 3, 2010.
[2] J. Montemayor, *Physical programming: tools for kindergarten children to author physical interactive environments,* University of Maryland, College Park, MD, USA: Thesis, 2003.
[3] Wyeth, "How Young Children Learn to Program with Sensor, Action, and Logic Blocks," Journal of the Learning Sciences, vol. 17, no. 4, pp. 517-550, 2008.
[4] M. Kindborg and P. Sökjer, "How preschool children used a behaviour-based programming tool," in *Proceedings of IDC 07*, Aalborg, Denmark, 2007.



# Clinky the Robot

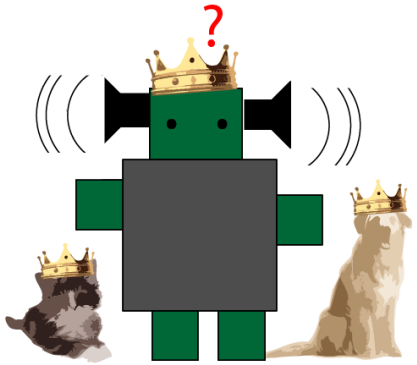
## Solution (Product)

iPad application to help young children (3-5) develop programming skills




Touch screens

Easy to use – Soon in classrooms – Easily available



# Clinky the Robot

## Related Work

### Guidelines

**Content:** Kahn & Morgado (Cookbook: 3-5)

**Interaction**: McKnight & Fitton (Touch Screens)

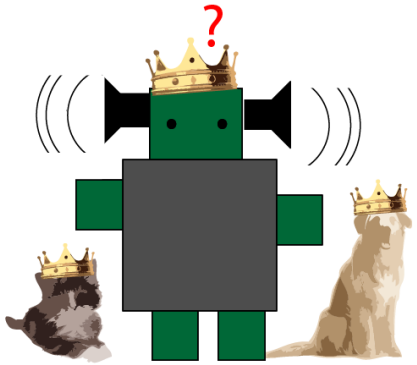
**Activity**: Lin & Liu (Child-adult Collaboration)

### Other Technologies (>5 years old)

Logo & sons, Scratch, Toontalk, Alice, Move the Turtle

### Limitation of the field

The bulk of the research is for **older children** and **not on touch screens**

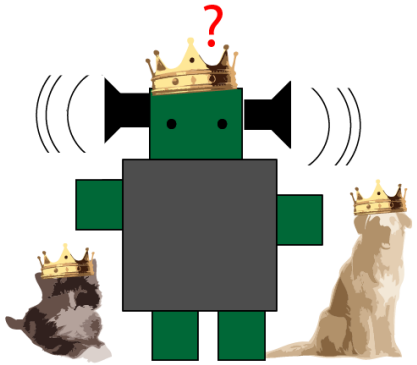


# Clinky the Robot

## Related Concepts

**Morgado and Cruz, Wyeth, Barr and Stephenson**

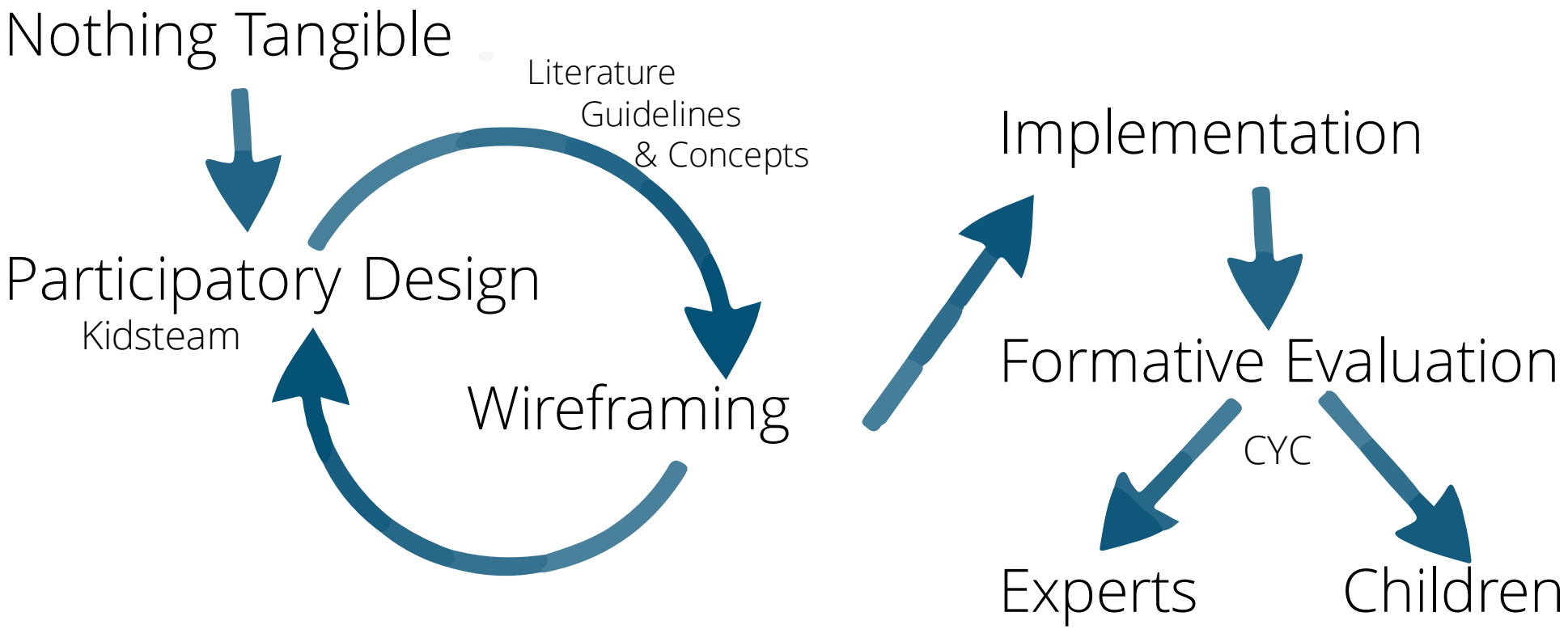
- Parallel Execution
- Compound Procedures
- Syntax and functionality
- Specific Outcomes
- Reusing parts
- Parameter Passing
- Debugging
- Planning
- Alternative solutions



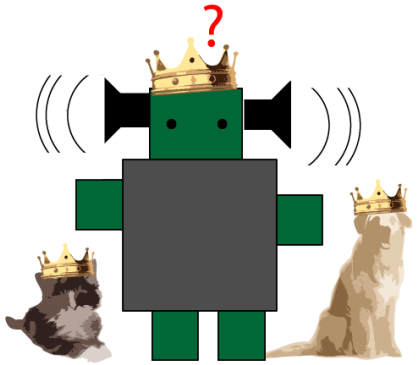
# Clinky the Robot

## Design Approach

## Cooperative Inquiry Techniques




A. Druin, "Cooperative inquiry: developing new technologies for children with children," in Proceedings of CHI 99, Pittsburgh, PA, USA, 1999.



# Clinky the Robot

## Kidsteam

Children-Adult Design Partnership
7 Adults, 8 Children, ages 7-11

Session 1: Robot activity and drawing (1h)

Goal: Initial Wireframe, Lots of ideas

Analysis: Big ideas, Debriefing, Observing themes

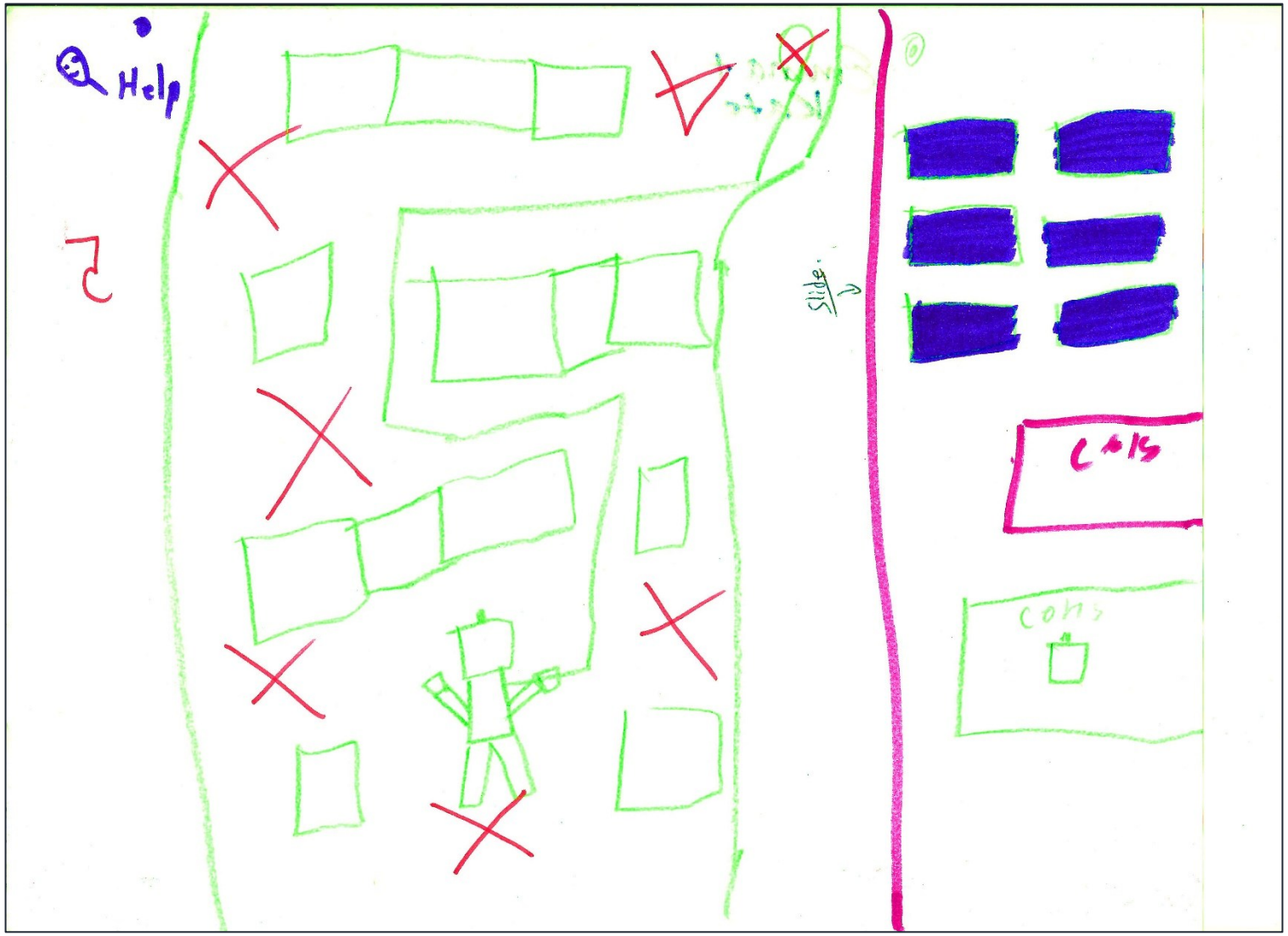
Results: Game

Separate levels

Robots & Castles

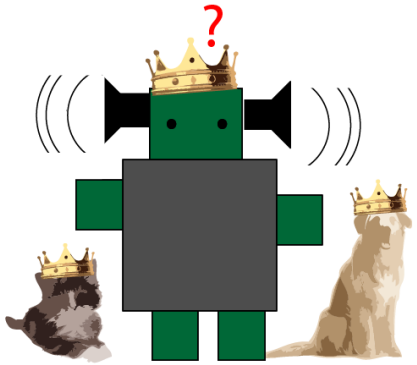
Customizability & Upgrades

Collecting Items




Drawing of the Application (Session 1)

# Circle Time!



# Clinky the Robot

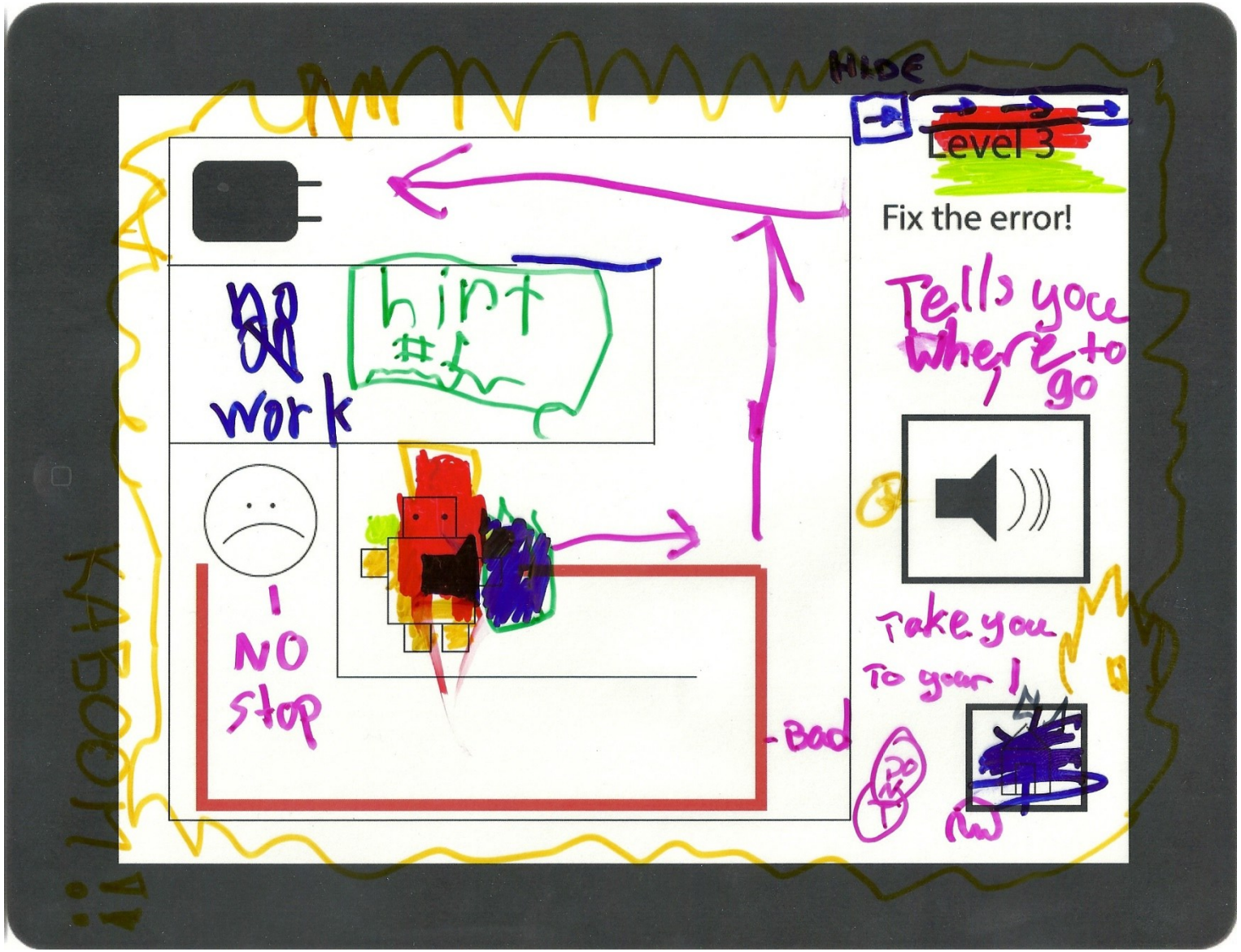
## Kidsteam – Layered Elaboration

**Session 2**: Rapid Iterations & Rotations (1h)

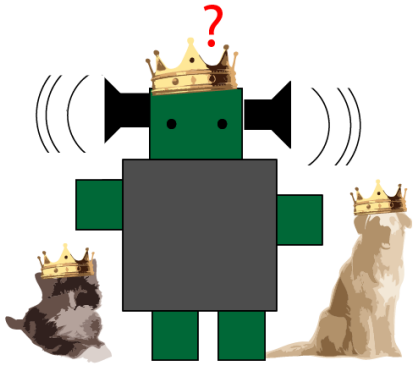
**Goal**: Brainstorm and build on the wireframe

**Analysis**: Themes – Notes & Designs

**Results**: Animals
Personal Experience
Positive Feedback
Currency
Surprises




# Layered Elaboration design



# Clinky the Robot

## Prototype (Demo)

5 levels

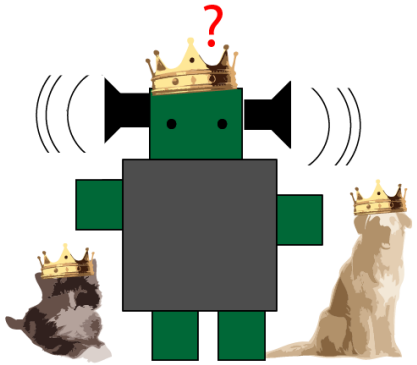
e.g. Planning, Debugging, Parallel execution, Syntax and Semantics, Compound Procedures...

## Motivation

Robot & Castle

Stars as Currency

Upgrades



# Clinky the Robot

## Formative Evaluation - Experts

Sessions 3 & 4: Interviews - Teachers of 3 & 4, 5 (20m)

Goal: Quality of interactions & learning

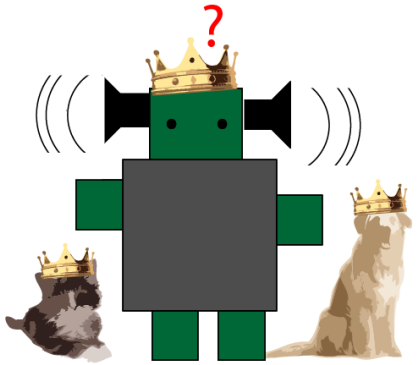
Results: Age Appropriate (almost)

Repeating

Practical Guidelines

>Touch interactions, Instructions

Guided VS Independent



# Clinky the Robot

## Formative Evaluation - Children

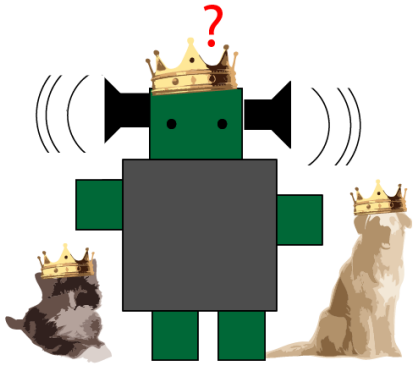
**Sessions 5, 6 & 8**: (20m)

6 Children in pairs of two (3 & 5, 4 & 4, 4 & 4)

**Goal**: Formative evaluation (Usability & Challenges)

**Results**: What the teachers said

| | |
|---|---|
| 5/5! ☺ | Expectations |
| Level 4 | Castle and stars |
| Drawing | Replaying |



# Clinky the Robot

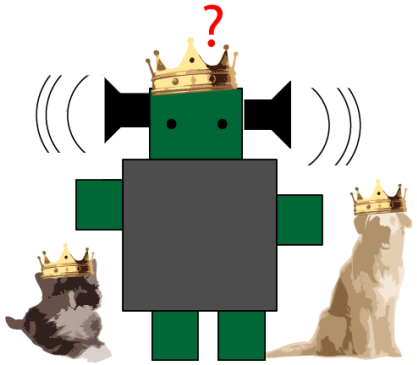
## Discussion

Children enjoy programming-like activities:
they can enrich the field of Computer Science

How do we integrate this in preschool education?

How do we scaffold the transition?

How do we design a guided activity?



# Clinky the Robot

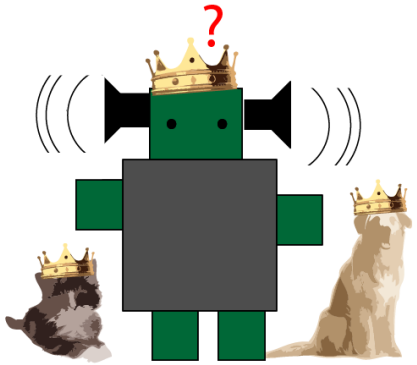
## Conclusion

The children liked it!

They wanted to play it again

The process of helping them learn is complicated

Children change a lot between 3 and 5



# Clinky the Robot

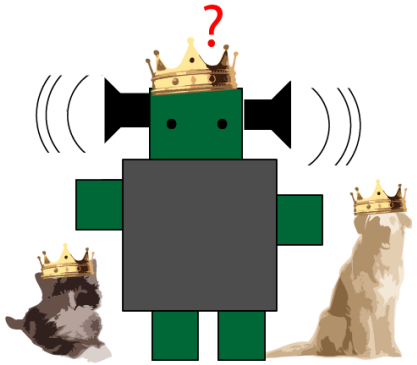
## Limitations

Not final

Evaluating learning outcomes

Not enough levels

Structuring the learning



# Clinky the Robot

## Future Work

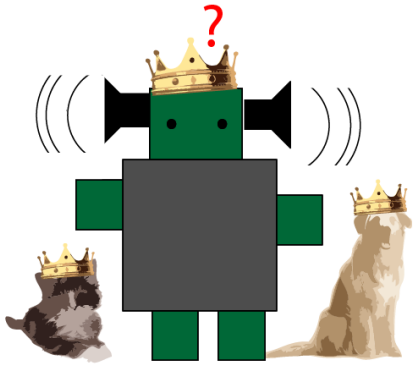
Designing for 3, 4, 5 and 5+

Implementing Repetition

How do concepts evolve over time

Designing for independent VS guided

Improving Usability (instructions and interactions)



# Clinky the Robot

## Acknowledgements

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