

## BACKGROUND TO PROBLEMS

### CONTEXTS / DEFINITIONS

0. In computer science “The halting problem” is that of determining whether for a given input a program will **stop (halt)** or **loop forever**.

1. Debugging is a necessary part of developing computational thinking. As Papert (1993) notes, The question to ask about the program is not whether it is right or wrong, but if it is fixable” and that analogously, learning involves, “becoming more articulate about one’s debugging strategies and more deliberate about improving them” (p.23).

2. I work in elementary mathematics teacher education with pre-service teacher candidates (PSTCs). I proposed to do work developing activities related to culturally relevant and respectful computational thinking. There were a few examples of ethnocomputation (eg. [Babbitt et al., 2015](#), [2012 Bennett, 2016](#); [Laiti, 2016](#)) and I had done work with ethnomathematics with PSTCs in another more familiar context ([Khan, 2010](#)) using kolam patterns. Reading the more recent critical literature on doing research work in mathematics education that is culturally respectful introduced some new ‘inputs’ (note not ‘bugs’) into my program that contributed to its halting.

3. I am a father of a curious pre-schooler. I am concerned about technology use at home and at school for my own and other children. I have a Cubetto early years robot at home. I’ve tried it out with my pre-schooler. I have some observations and concerns. I had a visit from a slightly older child and their parent. They took it for a spin. I have some observations and concerns. Cubetto is now sharing an office with me.

4. These two situations – culturally respectful CT and children’s relationships with robots – are complexed with other concerns about relationships in general and in particular with our planet in the Anthropocene which resonates with McKenzie’s (2013) critique of Maker culture as being about, “an amateur culture and a teaching culture that nibbles around the edges of a world that is made elsewhere.” There are fewer and fewer elsewhere. I have found Haraway’s Multispecies Ethical framework ([Haraway, 2015](#)) to be useful to think with and extends Levinasian framework I have used previously. Making kin she says involves collaboration and co-labouring with other terrans “make-with - become-with, compose-with” (p.161) involving a shift to sym-poiesis rather than auto-poiesis.

5. I contrast and connect “Making Kin” with a psychologised mathematics education’s pre-occupation with “making kinds” or distinctions and categories and the recent focus on make ken and think ken – or learning and doing mathematics with understanding.

6. Mathematics education and computational thinking must work simultaneously to re-establish a kin-ship with the rest of life (and more daringly with the non-living and once-living). To achieve this will mean re-connecting to our vulnerability and those of learners and learning systems.

## CULTURALLY SITUATED AND RESPECTFUL COMPUTATIONAL THINKING?

### Proposed Research Questions

What might computational thinking in educational settings look like beyond computer coding?

What cultural practices show promise for illustrating concepts of computational thinking?

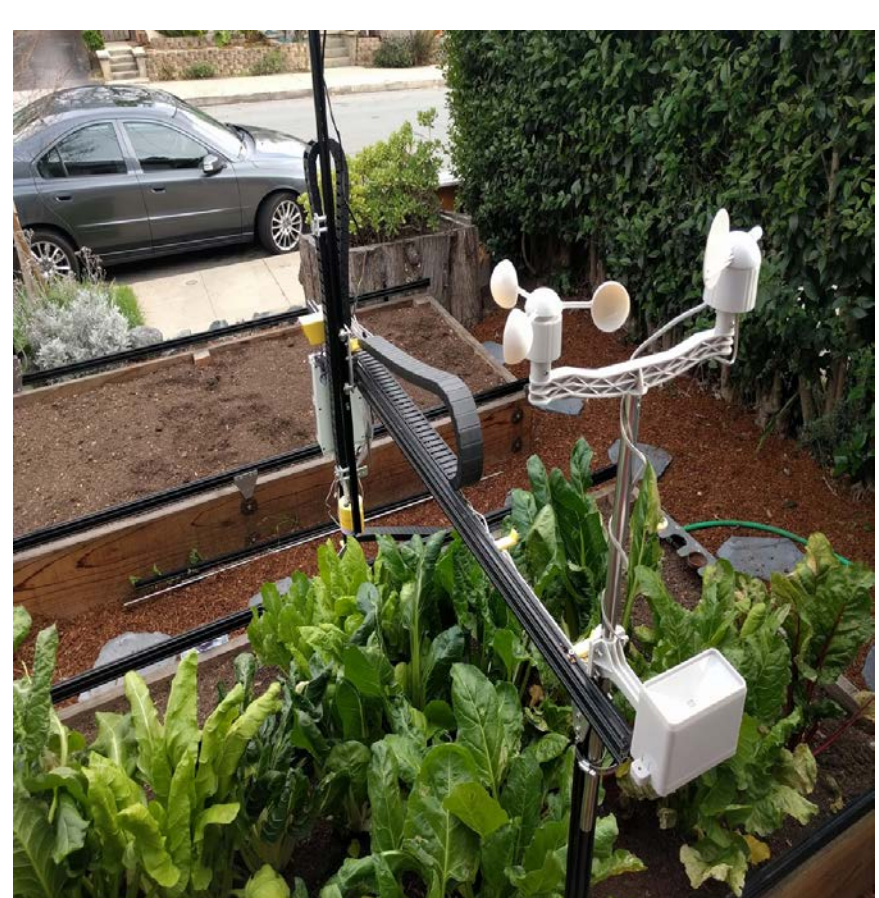
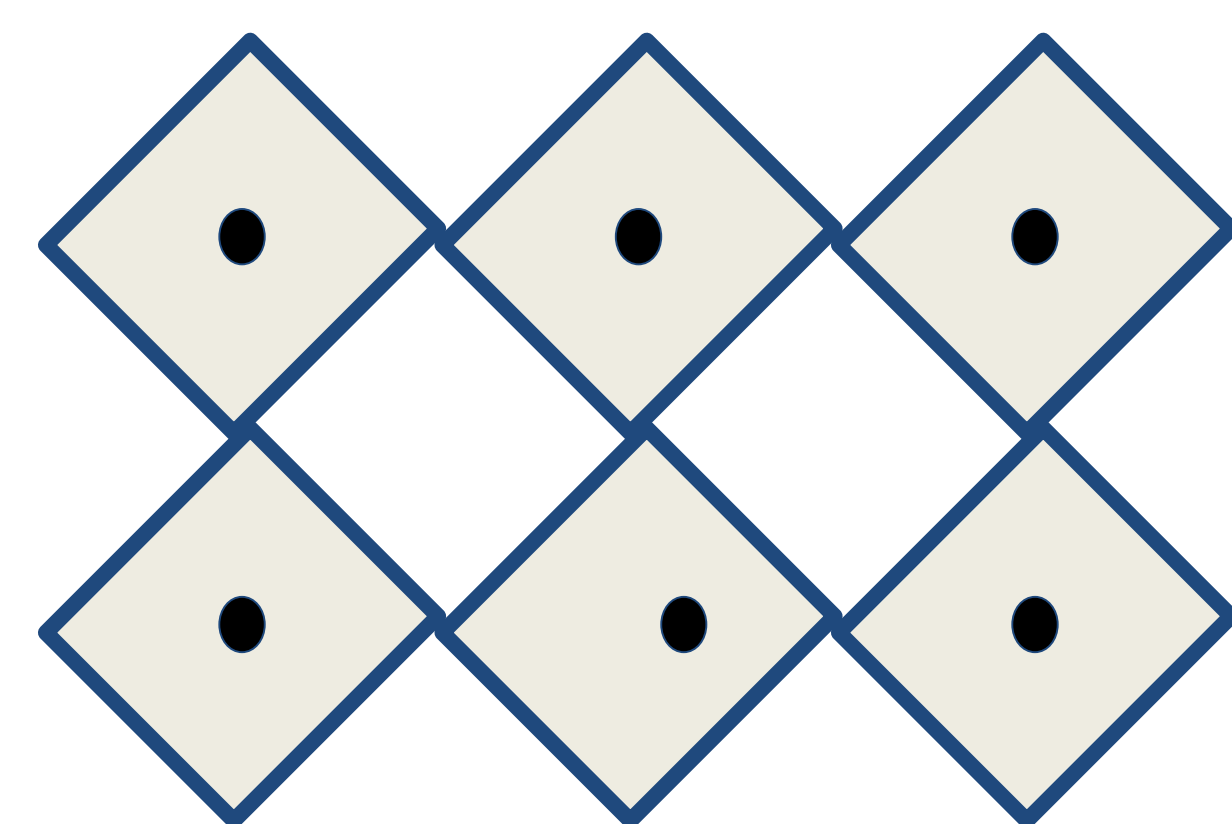
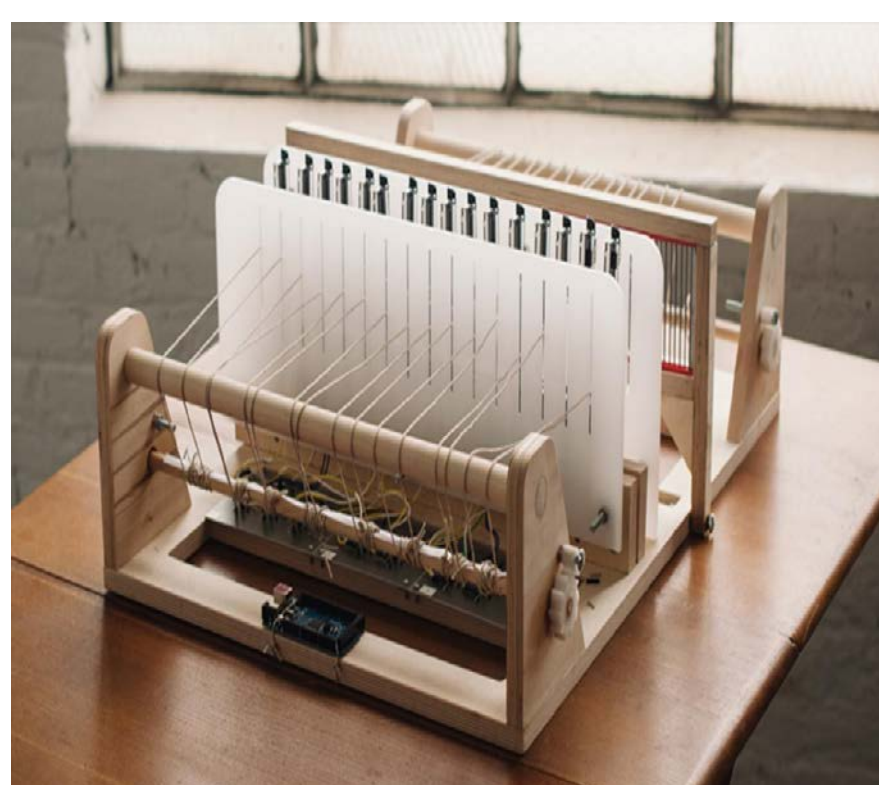
What constitutes computational knowledge for teaching computational thinking that is culturally situated and respectful?

What are the specific elements of these practices that might be developed into curricular interventions/resources for teachers and students?

Without a context and cultural community to work with, this became a project that bordered on appropriation. My thinking during the time was influenced by the TRCs Calls to Action and a number of cases and discussions of what constitutes cultural appropriation in the media.

This work is still important and should be done. It was not quite the right time or place and I wasn’t/ and am not yet a researcher able to do this work in this space.

## CULTURAL COMPUTATION?



Using only ‘turtle moves’ can you reproduce the pattern above on paper? In Scratch?

What is lost in this approach? What is gained?

## MAKE KIN WITH ROBOTS?

### CASE 1

Observing my daughter with Cubetto there is a fascination with the play-object. Her interactions are different from her interactions with other play-objects though closer to that with a pet. I observe also some frustration due to the fine motor skills required to fit the blocks into the holes. Papert (1993) had concerns about the influence of mechanized thinking machines on development of children’s values and self-image.

Kyriakidou et al (2017) note that there do not currently exist guidelines on robot ethics in ethical frameworks and suggest teachers and researchers have a duty to explain a robot’s operational nature to children and to report on this in their methodology. Other issues around preferential attachment for robots over humans and emotional distress due to perceived harm and not understanding the nature of a robot also a concern. With voice-assistants and A.I. features of social interaction and communicative norms of young children are being re-shaped (Rosenwald, March 2, 2017).

### Case 2

I had the opportunity to observe a parent and 6 year old child interact with Cubetto. Following the recommendation above I explained the nature of the robot and helped the child work out the correspondence between the blocks and the movements (F, L, R). I then observed as the parent and child played together on the floor.

The parent intervened regularly when child was working to make sense of why the robot wasn’t going where they wanted it to go., i.e. debugging their code through a mostly trial and error approach and serially building short, sequential bits of code that progressively moved them towards their goal.



### Think Kin & Make Kin

Computational Sustainability

Computational Ecologies

Computational Communities

Computational Identities

Computational Transformation

Computational Participation

Computational Thinking

Computational Experiences

Think Ken & Make Ken

Think Kinds/Make Kinds

## TOWARDS A KIN-ETHIC AGENDA

I would like to propose a kin-ethic agenda for mathematics education and computational thinking. This is, following Papert, through making a “mathematics that children love.”

In terms of culturally situated and respectful computational thinking, this is possible but I may have chosen badly or it may not have been the right time or set of conditions. However, this does require working with and in computational communities which are already part of other ecologies.

I want to propose that we also need to attend to how parents and children are interacting with coding, robots and computational thinking at home and in other settings and not confine our observations to teachers and learners in school and after-school locations. As with math and literacy practices in early years identity and dispositional aspects likely to be influenced here. We may need to teach caregivers explicitly how to engage in CT with kids.

Mathematics Education must find ways to re-establish relationships of responsibility, care and compassion and become kin once again with the rest of the multispecies world. In the mathematical world however this means helping learners to re-cognise their kin-ship, their relatedness and sense of belonging to the discipline that they study and to the entities therein. For example, if one can have kin-ship with a rhombus, maybe we can also have kinship with a robot

In learning from our inter-generational kin we must keep at forefront Papert’s warnings around ‘primitive models’ of programming becoming established in schools, routinized curricula computers “being used to program the child” (Papert, 1993).

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