Fabric-based computing: Materials as non-neutral drivers of computer science learning

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RESEARCH QUESTIONS

- What computational concepts do youth produce while weaving and manipulating fabric?
- How do the material-discursive processes of these crafts drive computation and learning?

METHODS

SETTINGS AND PARTICIPANTS

- Midwestern K-8 charter school.
- Two 6-session long fiber crafts courses (70 minutes/session:
  - Weaving: threading yarn through weft.
  - Fabric manipulation: sewing 2d graphics into 3d shapes.
- 16 participants; grade 6-8; age 11-14; 8 girls, 8 boys.

DATA SOURCES

- Video of course sessions (13.5 hours).
- Video semi-structured interviews (6.25 hours).
- Project photographs (20 per youth/session).

ANALYTICAL TECHNIQUES

- Thinking with theory (Jackson & Mazzei, 2012).
- Video coding of performed computational concepts in crafts.
- Pseudo-coding of youth projects.

FINDINGS: WEAVING

COMPUTATIONAL CONCEPTS


```
def row_by_row(dur, heddle):
    i = 0
    while i < dur:
        if heddle == 1:
            start at warp 1
            28 to right
        if heddle == -1;:
            start at warp 28
            28 to left
        if heddle == 1:
            heddle = -1
        if heddle == -1:
            heddle = 1
        i += 1

color = "green"
row_by_row (21,1)
```

- **Variables:** Repetitions selected during and at the start of the craft.
- **Conditionals:** Heddles that youth pulled up or down.
- **Functions:** Repeated weaving performed while loops.

MATERIAL-DISCURSIVE COMPUTATIONAL LEARNING

- The loom asking to **weave into the matrix** of warp threads.
- Computation was characterized by a **move toward regularity**.
- Computational learning became the **performance of automation.**

FINDINGS: FABRIC MANIPULATION

COMPUTATIONAL CONCEPTS

- **Variables:** Matrix-dots that youth traced and sewed together.
- **Conditionals:** Youth decided if dots were available.
- **Functions:** Youth performed for-loops by sewing units.

MATERIAL-DISCURSIVE COMPUTATIONAL LEARNING

- Sewing called for **distorting the matrix** on the fabric.
- Computation was characterized by pattern **regularity AND speculations** of 3D transformational possibilities.
- Computational learning became the performance of **automation and speculative 3D modeling in physical space.**
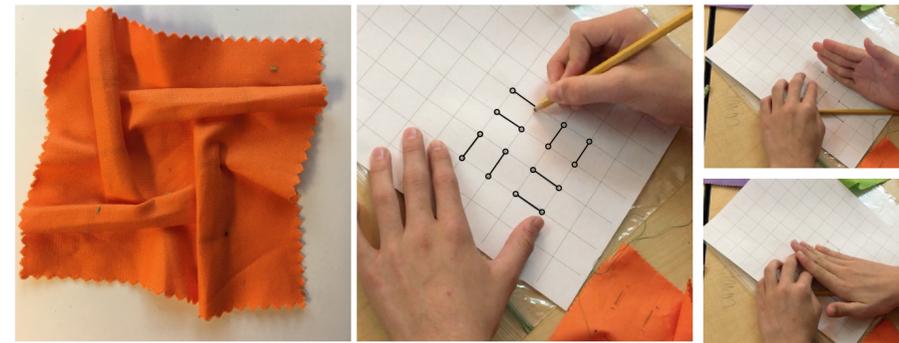
BACKGROUND

- **Fiber crafts as context for computing:** Jacquard loom is a computational precursor (Essinger, 2004).
- **Constructionism:** Children can come to know disciplinary concepts in multiple ways (Turkle & Papert, 1992).
- **Posthumanist perspectives:** Materials play an active role in learning possibilities (Barad, 2008).

DISCUSSION

MATERIALS ARE NON-NEUTRAL

- They drive performance of computational concepts.
- They privilege different ways of learning.

IMPLICATIONS

- **Challenge the stability** of computational doing
- Different materials support a **range of understanding of what computing is.**

REFERENCES

- Barad, K. (2008). Posthumanist performativity: Toward an understanding of how matter comes to matter. In S. Alaimo & S. Hekman (Eds.), Material Feminisms. Bloomington, IN: Indiana University Press.
- Essinger, J. (2004). Jacquard's web: how a hand-loom led to the birth of the information age. Oxford University Press on Demand.
- Jackson, A. Y., & Mazzei, L. A. (2012). Thinking with theory in qualitative research: Viewing data across multiple perspectives. New York, NY: Routledge.
- Turkle, S., & Papert, S. (1992). Epistemological pluralism and the revaluation of the concrete. Journal of Mathematical Behavior, 11(1), 3-33.