

Copying the lab key, or: How to apply the Algebra Project to science teacher professional development

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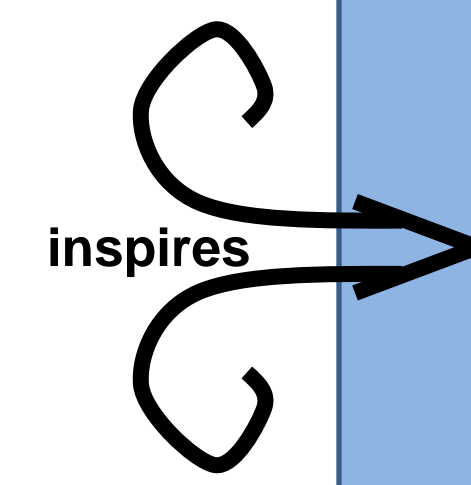
Quine: Science as “Regimentation of ordinary discourse”



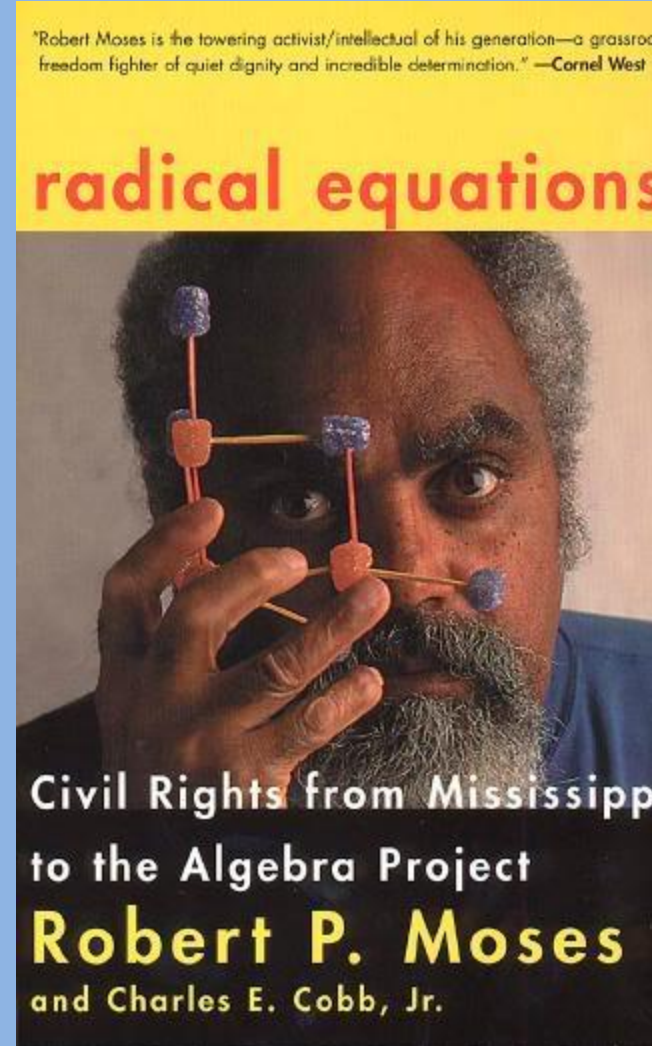
The common man's ontology is vague and untidy in two ways. It takes in many purported objects that are vague and inadequately defined. But also, what is more significant, it is vague in scope; we cannot even tell in general which of these vague things to ascribe to a man's ontology at all, which things to count him as assuming. ...

My point is not that ordinary language is slipshod, slipshod though it be. We must recognize this grading off for what it is, and recognize that a **fenced ontology is just not implicit in ordinary language**. The idea of a boundary between being and non-being is a philosophical idea, an idea of technical science in a broad sense. Scientists and philosophers seek a comprehensive system of the world, and one that is oriented to reference even more squarely and utterly than ordinary language. **Ontological concern** is not a correction of a lay thought and practice; it is **foreign to the lay culture**, though an outgrowth of it.

We can draw explicit ontological lines when desired. **We can regiment our notation...** At other points new ontic commitments may emerge. There is room for choice, and one chooses with a view to simplicity in one's overall system of the world. (From *Things and their Place in Theories*)



This:



Moses: Providing access to regimented discourse

- What do we believe is important?
- How do we show?

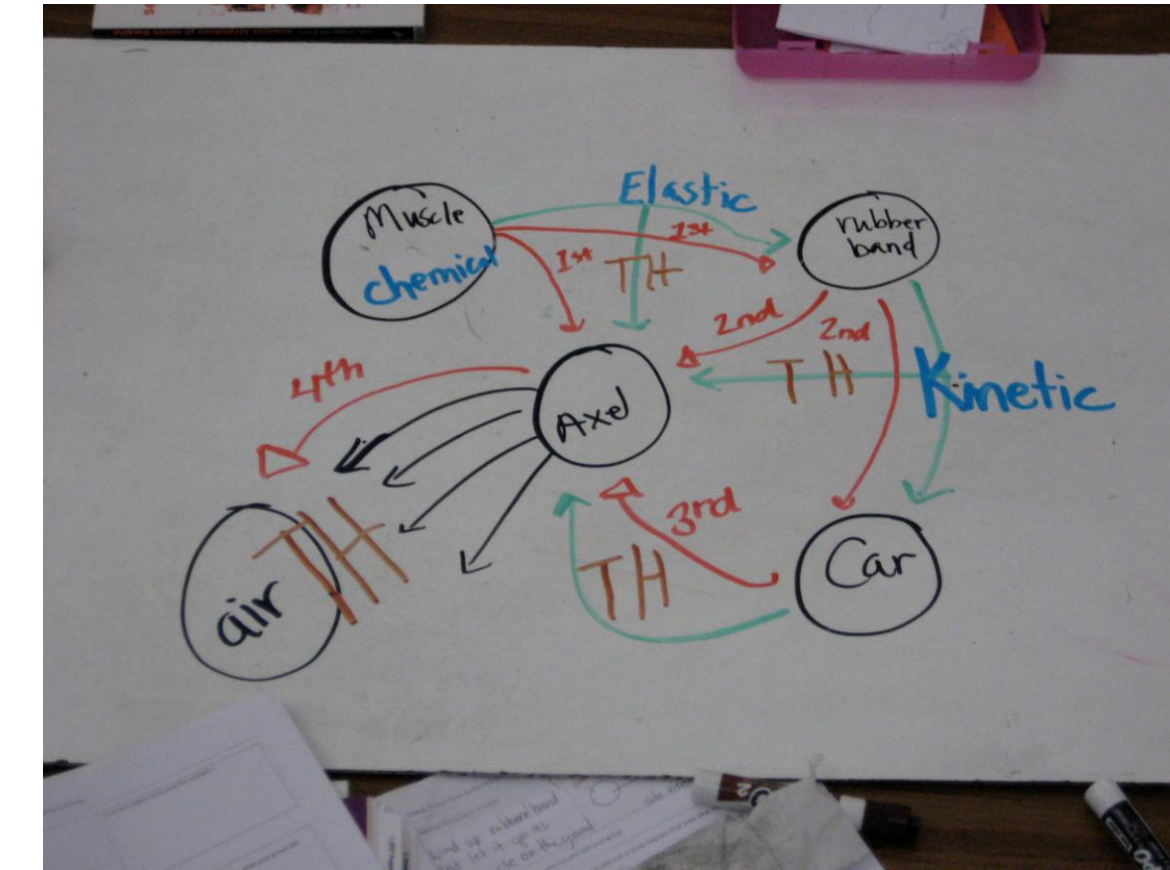
(Contrast with this:)



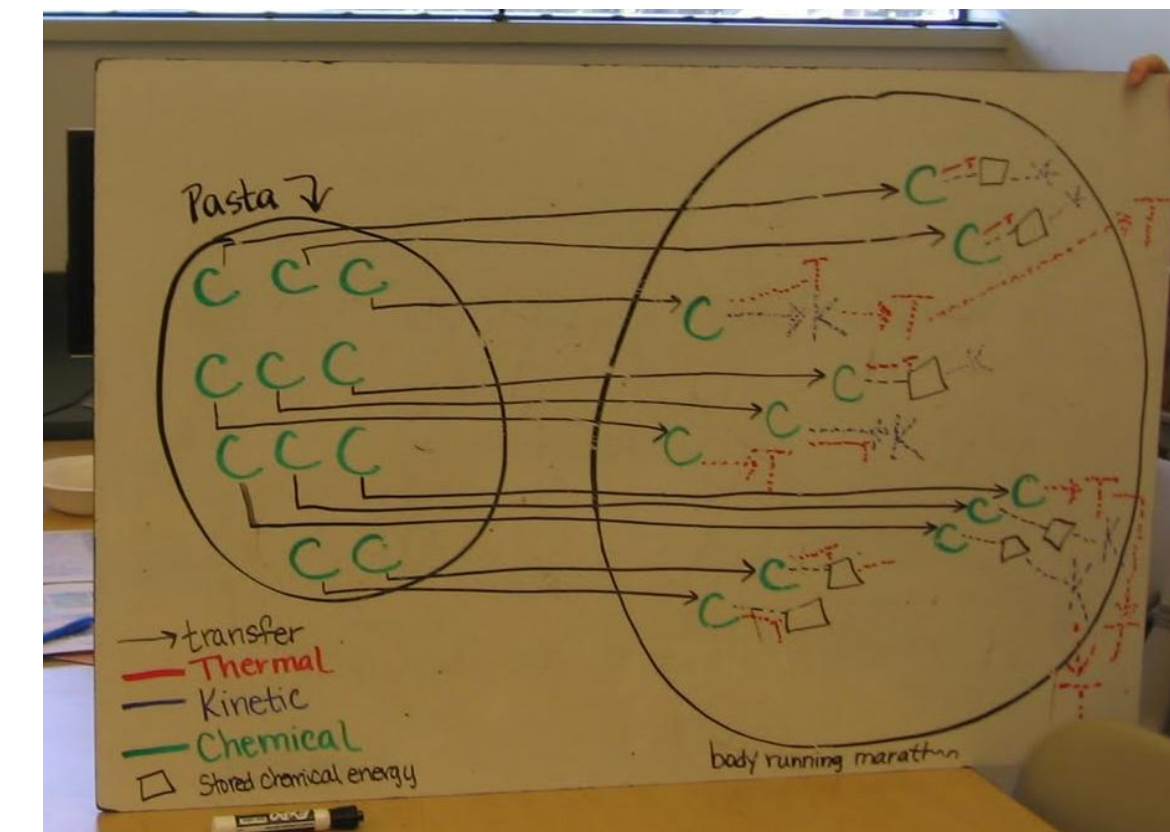
Arnold B. Arons

- Why do we believe?
- How do we know?

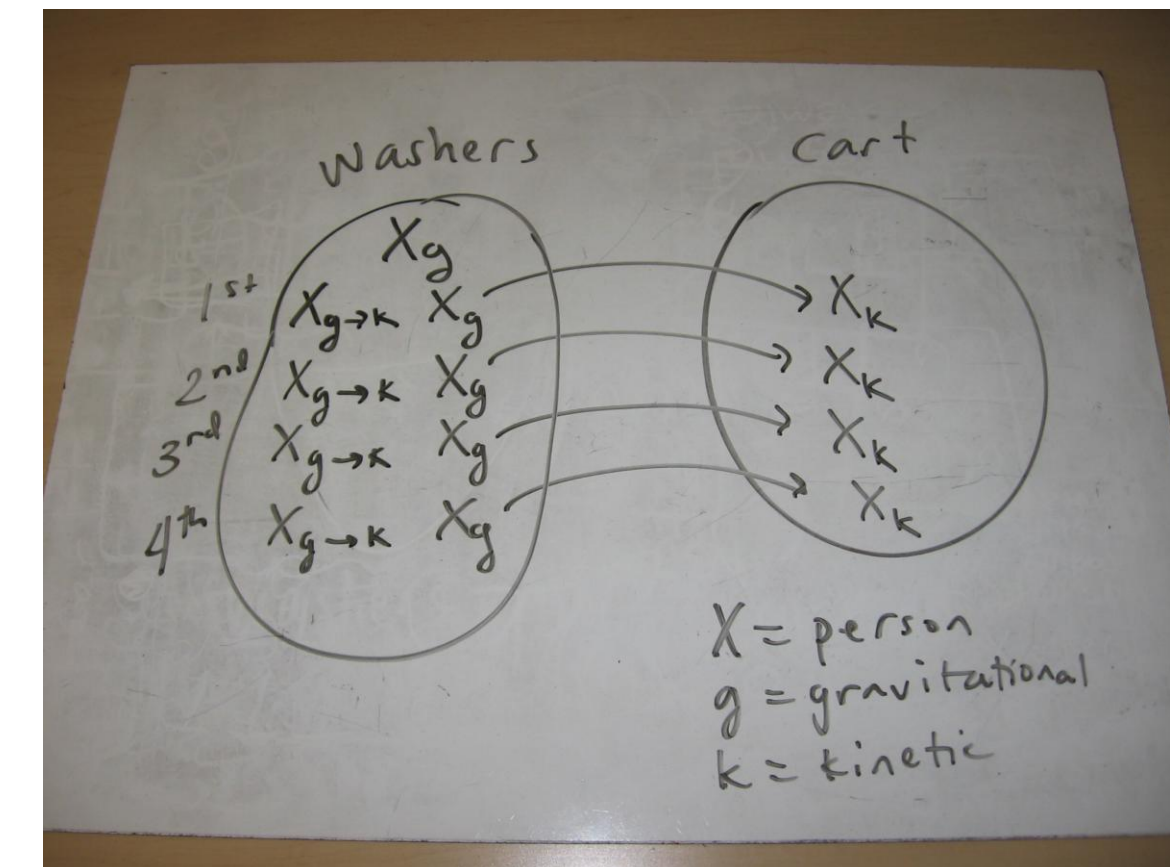
A rubber-band car is wound up, let go, and it rolls to a stop.



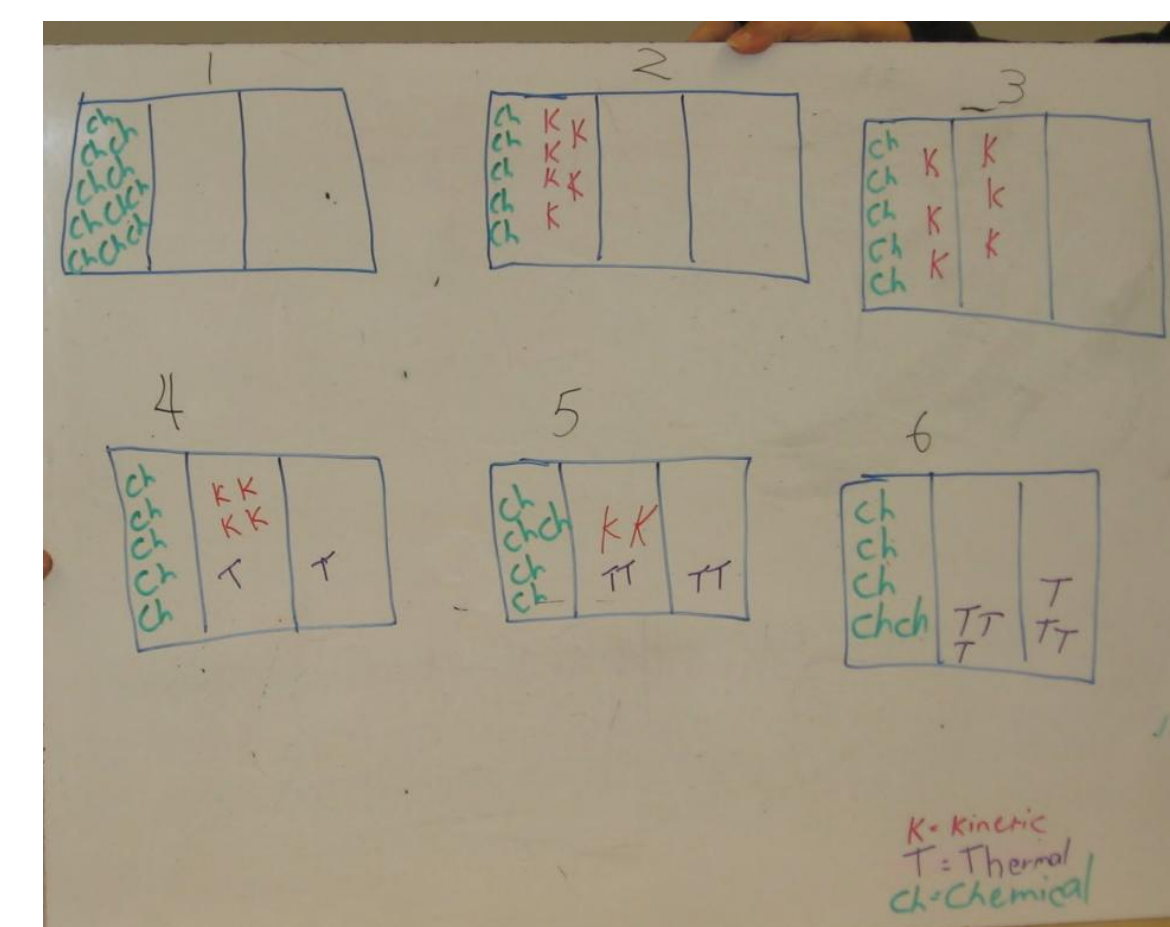
A runner eats pasta and then runs a marathon.



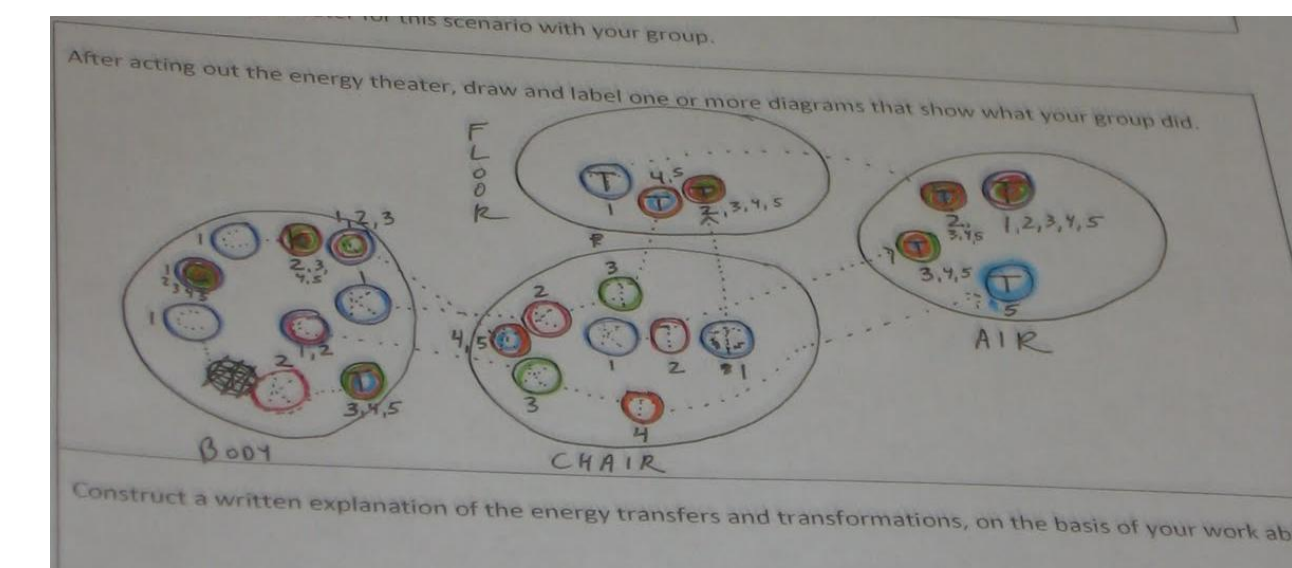
A modified Atwood's machine is let go, and it speeds up.



A chair is suddenly shoved across the floor.




The chair is pushed at constant speed.



Teacher & student empowerment and the demystification of scientific knowledge:

I think that, for so long, science was taught in a lockstep-sort-of-way, and I think now scientists are moving away from that because they're understanding that just because we thought things were like they were for years, that doesn't mean that it is true. So I think it's good when people that enter into science whether they're in 2nd grade or they're in their 25th year in college, it gives them the opportunity to have some *input*, that somebody hadn't thought about, you know? And that furthers science, when that happens, when we're all kinda thinking about it, and can *talk* about it, that's how science is furthered. Rather than, kinda being in a *lab*, and just this certain little *group*, y'know, has keys to the lab. So, I just think it's wonderful for children to be able to bring their thinking out in a way that's *OK*, because y'know some of the most off-the-wall thoughts have been scientific breakthroughs... So, you know I'm OK with it – I think too often we just like closure: Oh, you know, it's THIS.



5 steps of the Algebra Project method	General description	As in Algebra Project	As in Energy Project
1. Physical Events	Some concrete, embodied experience with too much information	Students take a trip on the Boston T 	Teachers stroll along the canal for raw, concrete experience of energy “doing what it does,” watch and study a Rube Goldberg video
2. Pictorial Representation / Modeling	Draw and label anything from your experience that seemed significant	Students choose to generate a mix of factual and personal accounts of the trip	Teachers choose to generate “snapshot” pictures with focus on concrete objects
3. Intuitive Language / “People Talk”	Talk and write about your experience in your own terms. <i>Regimenting questions are premature!</i>		Teachers talk mostly about chains of causes, with generally over-inclusive scope: <i>many</i> objects, <i>many</i> processes
4. Structured Language / “Feature Talk”	After reviewing many different accounts of the event(s), identify key features	Students conclude that <i>start</i> , <i>finish</i> , <i>direction</i> , and <i>distance</i> are the key features of all trips	Teachers negotiate list of features that restricts attention to <i>definite set of relevant objects</i> , <i>start and finish times</i> , <i>forms of energy</i> , <i>amounts of energy</i> , and <i>evidence</i>
5. Symbolic Representation	Featured information is encoded in private, invented symbolic language systems that are increasingly examined and critiqued	Varied student-generated diagrams that are isomorphic to the number line	Complex, accurate representations of the dynamics of <u>energy theater</u> , on paper

A feature is NOT:	Examples
A concrete object	Jocelyn
A general principle	Men are taller than women, on average.
A feature IS:	
A field that can take on different values	The height of Jocelyn is 1.7 m.

See PERC poster: “Energy Theater” Scherr, et al.