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PRODUCTIVE PHYSICAL INTUITIONS ABOUT PATTERNS OF MOTION

ELICITING AND REFINING INTUITIONS WITH **BREACHING ARTIFACTS**

SJSU | DEPARTMENT OF
PHYSICS AND ASTRONOMY

Berkeley
UNIVERSITY OF CALIFORNIA

with special thanks to Andrea A. diSessa



INTUITION

noun in·tu·i·tion \in-tü-'i-shən\

quick and ready
insight

immediate
apprehension or
cognition

<http://www.merriam-webster.com/dictionary/intuition>

2



INTUITION

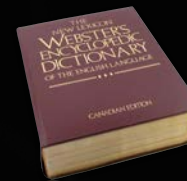
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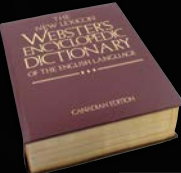
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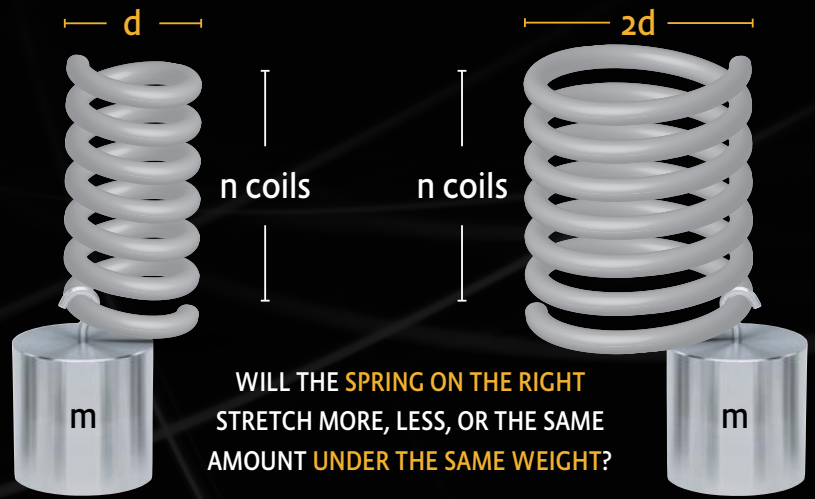
Dewey (1886):
Every act of mind involves **relation**, ...
dependence, ... [and] **mediation**.
Intuition must be defined to include this factor.

Dewey, J. (1886). *Psychology*. Harper & Brothers. New York, NY.

http://www.merriam-webster.com/dictionary/intuition

2

PHYSICAL INTUITIONS ABOUT SPRINGS

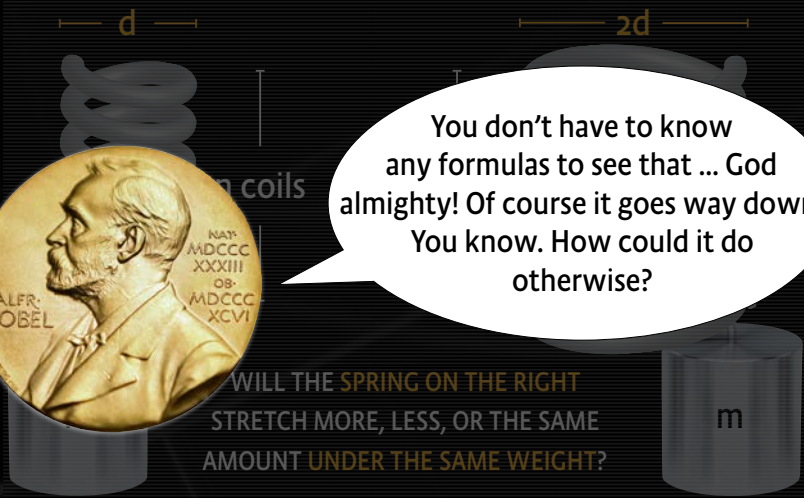


WILL THE **SPRING ON THE RIGHT** STRETCH MORE, LESS, OR THE SAME AMOUNT **UNDER THE SAME WEIGHT?**

Clement, J. (1994). Imagistic simulation and physical intuition in expert problem solving. In Proceedings of the 16th annual conference of the Cognitive Science Society, 201-206.

3

PHYSICAL INTUITIONS ABOUT SPRINGS



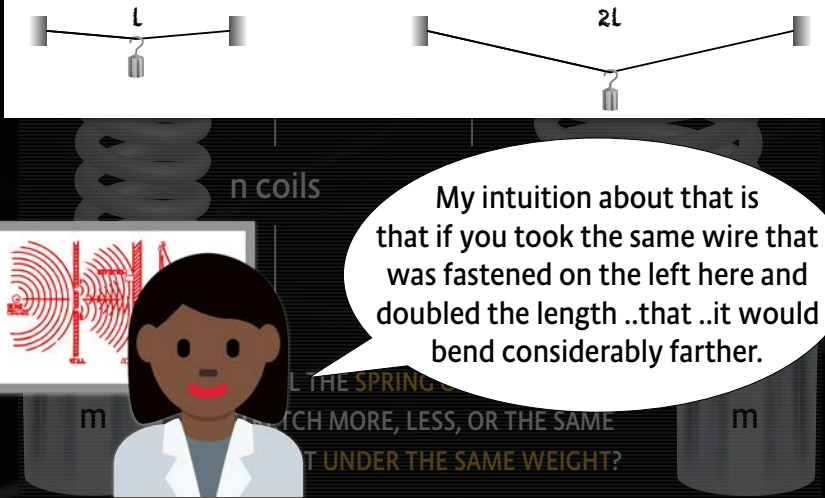
You don't have to know any formulas to see that ... God almighty! Of course it goes way down. You know. How could it do otherwise?

WILL THE **SPRING ON THE RIGHT** STRETCH MORE, LESS, OR THE SAME AMOUNT **UNDER THE SAME WEIGHT?**

Clement, J. (1994). Imagistic simulation and physical intuition in expert problem solving. In Proceedings of the 16th annual conference of the Cognitive Science Society, 201-206.

3

PHYSICAL INTUITIONS ABOUT SPRINGS



My intuition about that is that if you took the same wire that was fastened on the left here and doubled the length ..that ..it would bend considerably farther.

WILL THE **SPRING ON THE RIGHT** STRETCH MORE, LESS, OR THE SAME AMOUNT **UNDER THE SAME WEIGHT?**

Clement, J. (1994). Imagistic simulation and physical intuition in expert problem solving. In Proceedings of the 16th annual conference of the Cognitive Science Society, 201-206.

3

REFINING PHYSICAL INTUITIONS BY EXAMINING IDEAS ABOUT THE WORLD



4

REFINING (DISCIPLINARY) INTUITIONS BY MAKING THE FAMILIAR STRANGE

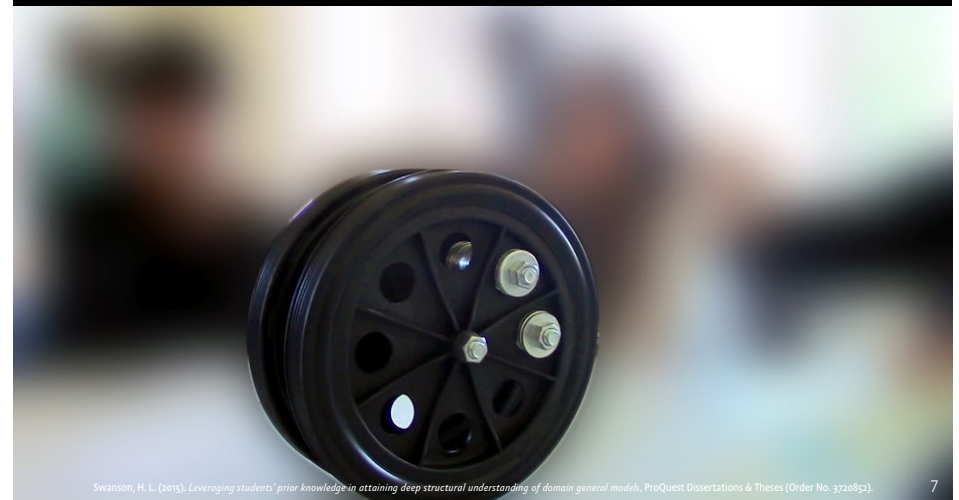


GARFINKEL'S BREACHING EXPERIMENTS NOTICE THE SEEN BUT UNNOTICED ABOUT THE SOCIAL WORLD



6

BREACHING EXPERIMENTS IN PHYSICS NOTICE THE SEEN BUT UNNOTICED ABOUT THE PHYSICAL WORLD



7

WEIGHTED WHEEL FOR REFINING INTUITIONS ABOUT MOTION



Andrea A. diSessa



Swanson, H. L. (2015). Leveraging students' prior knowledge in attaining deep structural understanding of domain general models. ProQuest Dissertations & Theses (Order No. 3720852).

7

WEIGHTED WHEEL AS BREACHING ARTIFACT: ELICITING AND REFINING PHYSICAL INTUITIONS



8

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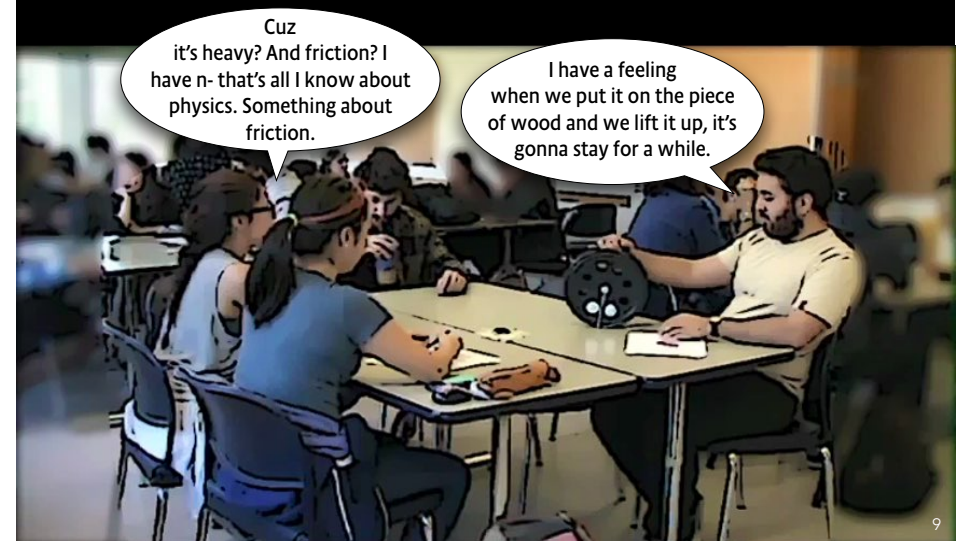


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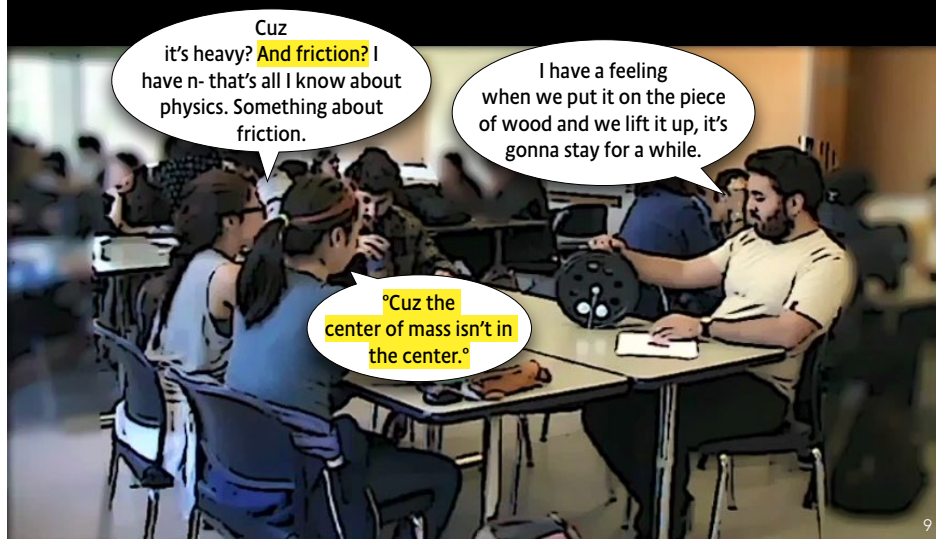
PHYSICAL INTUITIONS ABOUT THE MOTION OF THE WEIGHTED WHEEL



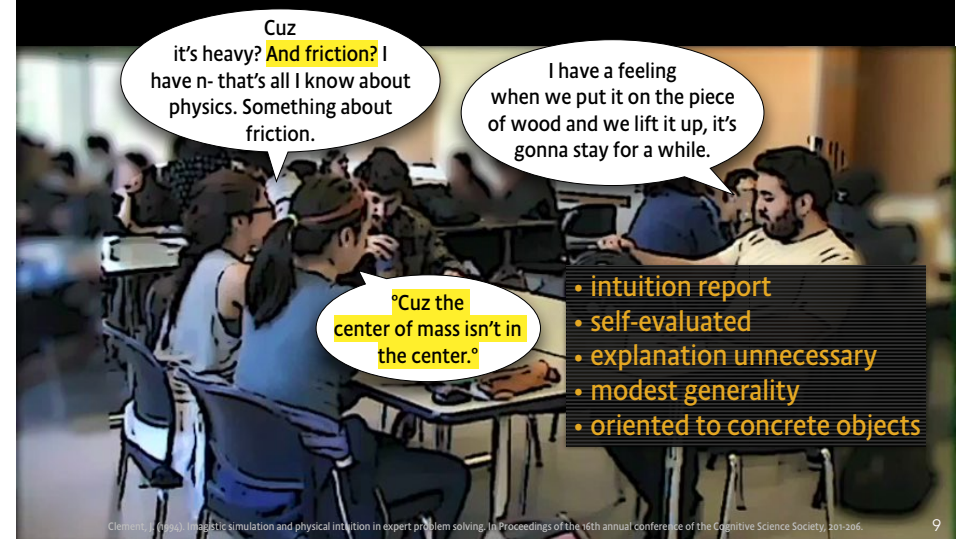
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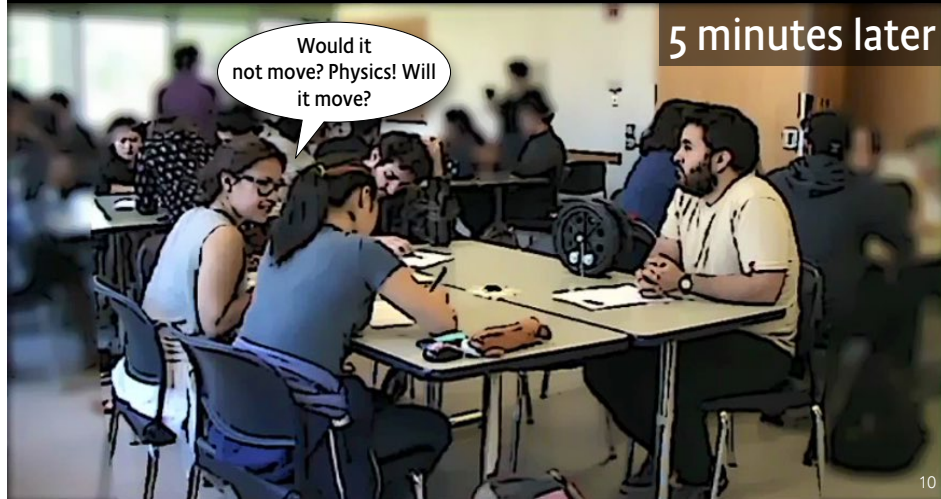
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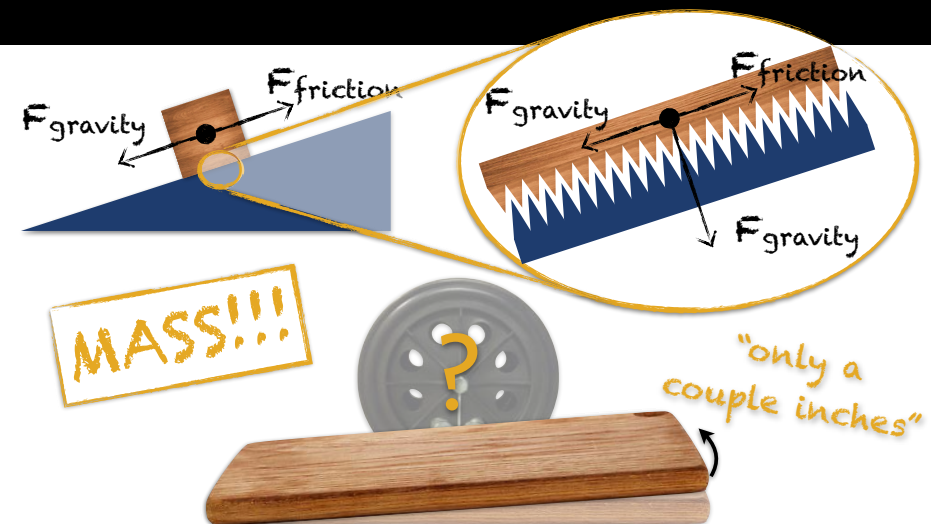
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I think **in this case** though, it's more than just mass, we have to deal with like rotational inertia and stuff. **If it was just like a block--**

13

PHYSICAL INTUITIONS ABOUT THE MOTION OF THE WEIGHTED WHEEL

--it would be **very different than like this** where it's gonna tilt to one side and I know absolutely nothing about the rotational part of physics

13

PHYSICAL INTUITIONS ABOUT THE MOTION OF THE WEIGHTED WHEEL

Yeah like you were saying the center of mass, right? It's not evenly- the mass isn't equally distributed throughout the whole wheel.

14

PHYSICAL INTUITIONS ABOUT THE MOTION OF THE WEIGHTED WHEEL

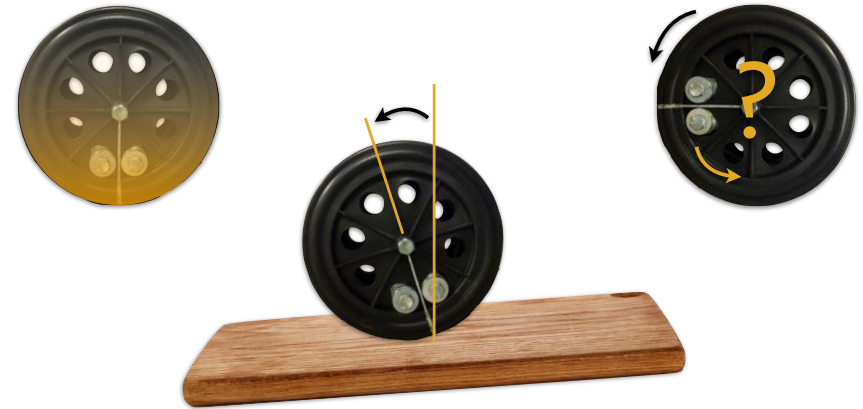
If we put it so that wasn't on the bottom, would it more likely roll? Cuz then it wants to put the heavy thing on the bottom, right?

14

PHYSICAL INTUITIONS ABOUT THE MOTION OF THE WEIGHTED WHEEL



PHYSICAL INTUITIONS ABOUT THE MOTION OF THE WEIGHTED WHEEL



CONCLUSIONS: BREACHING ARTIFACTS

- elicit learners' intuitions about the physical world by making seen-but-unnoticed features salient
- provide productive context for collaboratively examining those intuitions and refining them
- by themselves may not be enough