Title: Thermodynamics and Information

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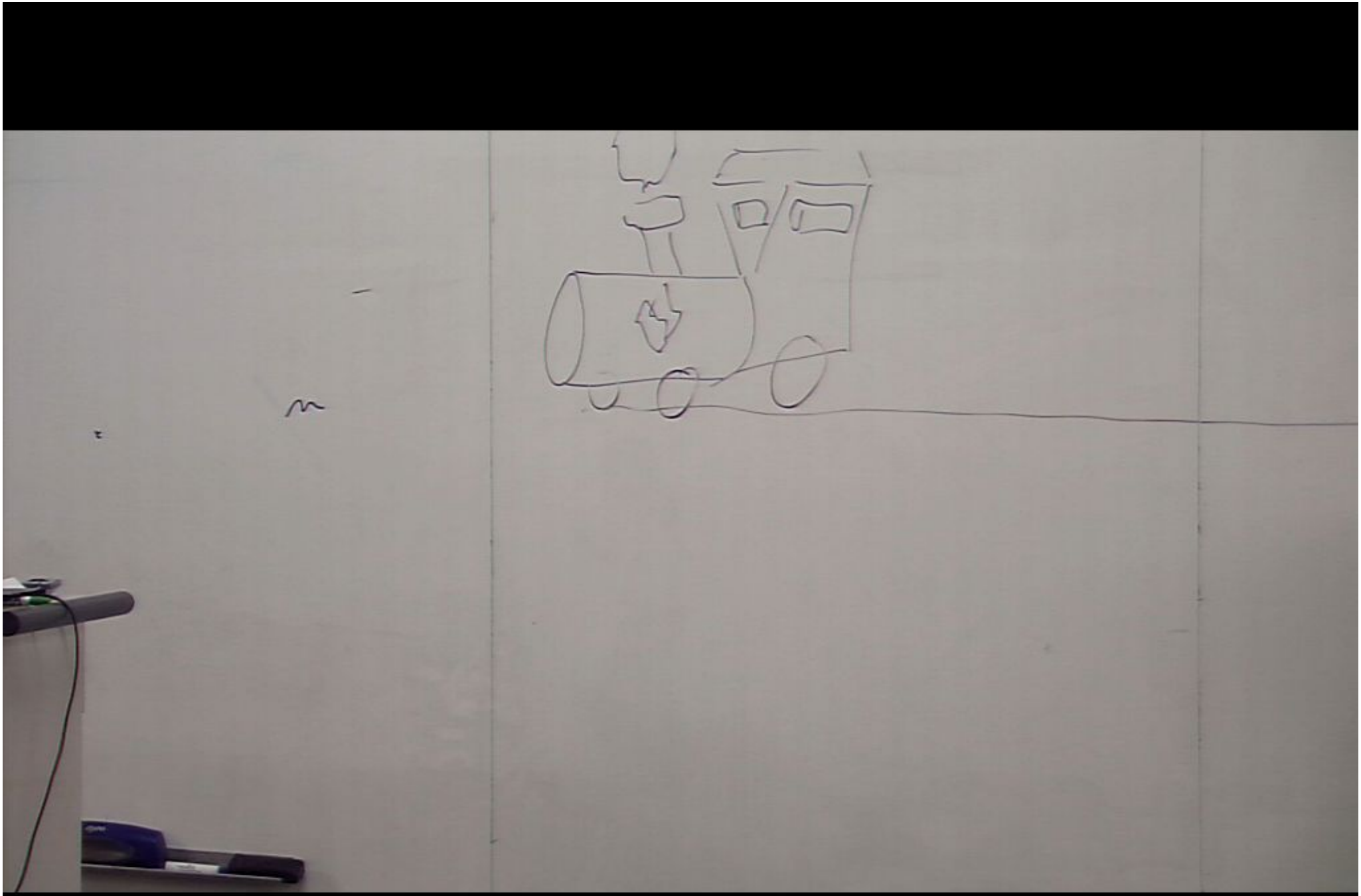
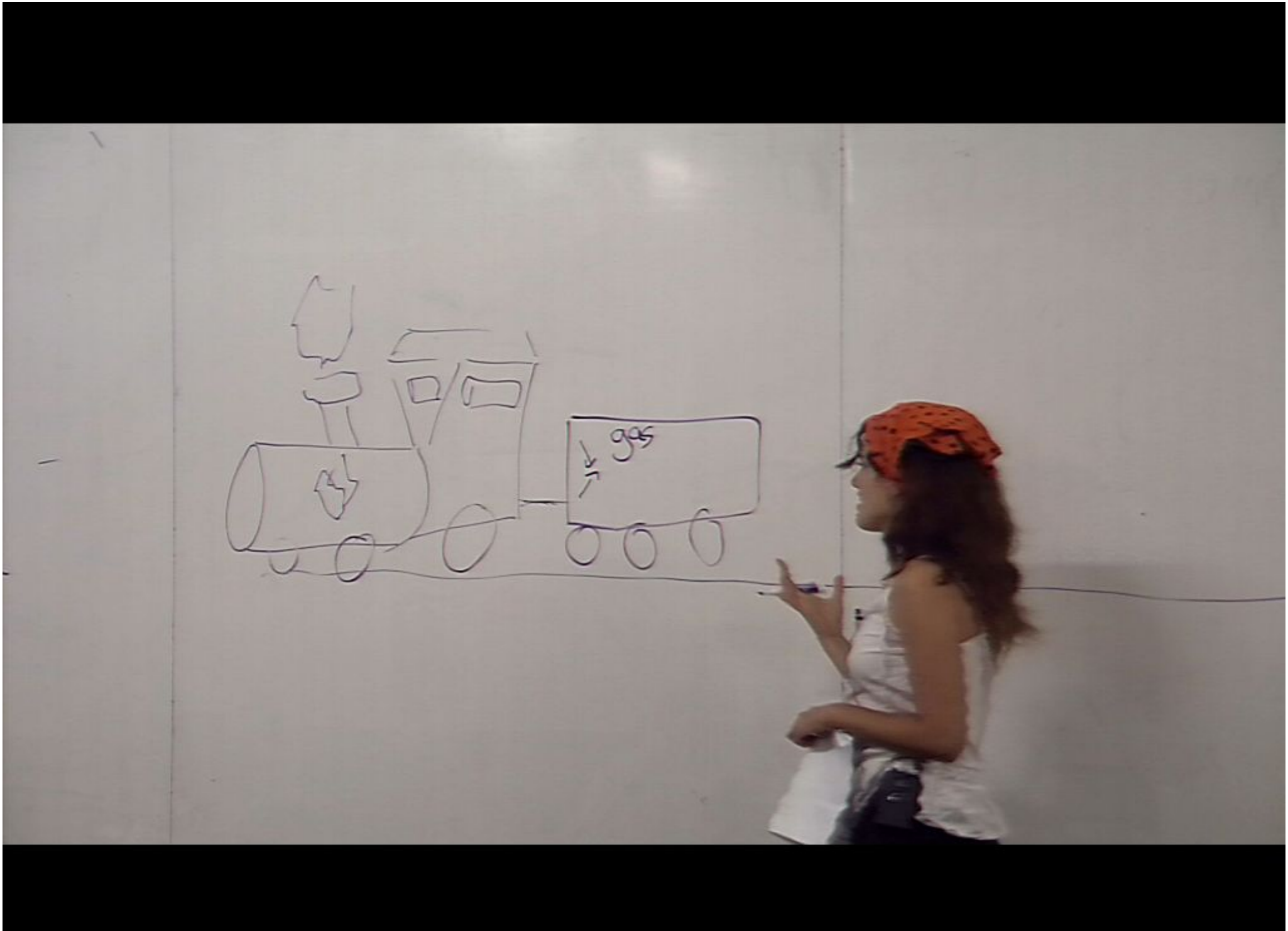
Abstract: Thermodynamics is, at heart, a probabilistic theory about the state of physical systems. Traditionally, however, our knowledge of systems is modelled implicitly: for instance, it is often assumed that we only have access to a few macroscopic parameters, like the temperature, energy, or volume of a gas, and that all states satisfying those parameters are equally likely.
Another example is Maxwell's demon, an apparent violation of the second law: a demon operates the trapdoor between two boxes filled with a gas at the same temperature. He lets fast particles fly to the right box, cooling the left container and heating the right one at no work cost. The paradox comes from ignoring the demon's memory, a system where he stores his information about the speed of the particles, which has finite capacity. Eventually, he will have to erase his memory, an irreversible operation that costs him work.
Classical and quantum information theory have given us tools to model knowledge explicitly: we use them to analyse the security of cryptographic protocols, or how much information can be sent through a noisy channel, for example. In this talk, I will explore what happens when we apply information-theoretical tools to thermodynamics. In particular, I will discuss the implications of having quantum information about a physical system, with the example of erasure of information.

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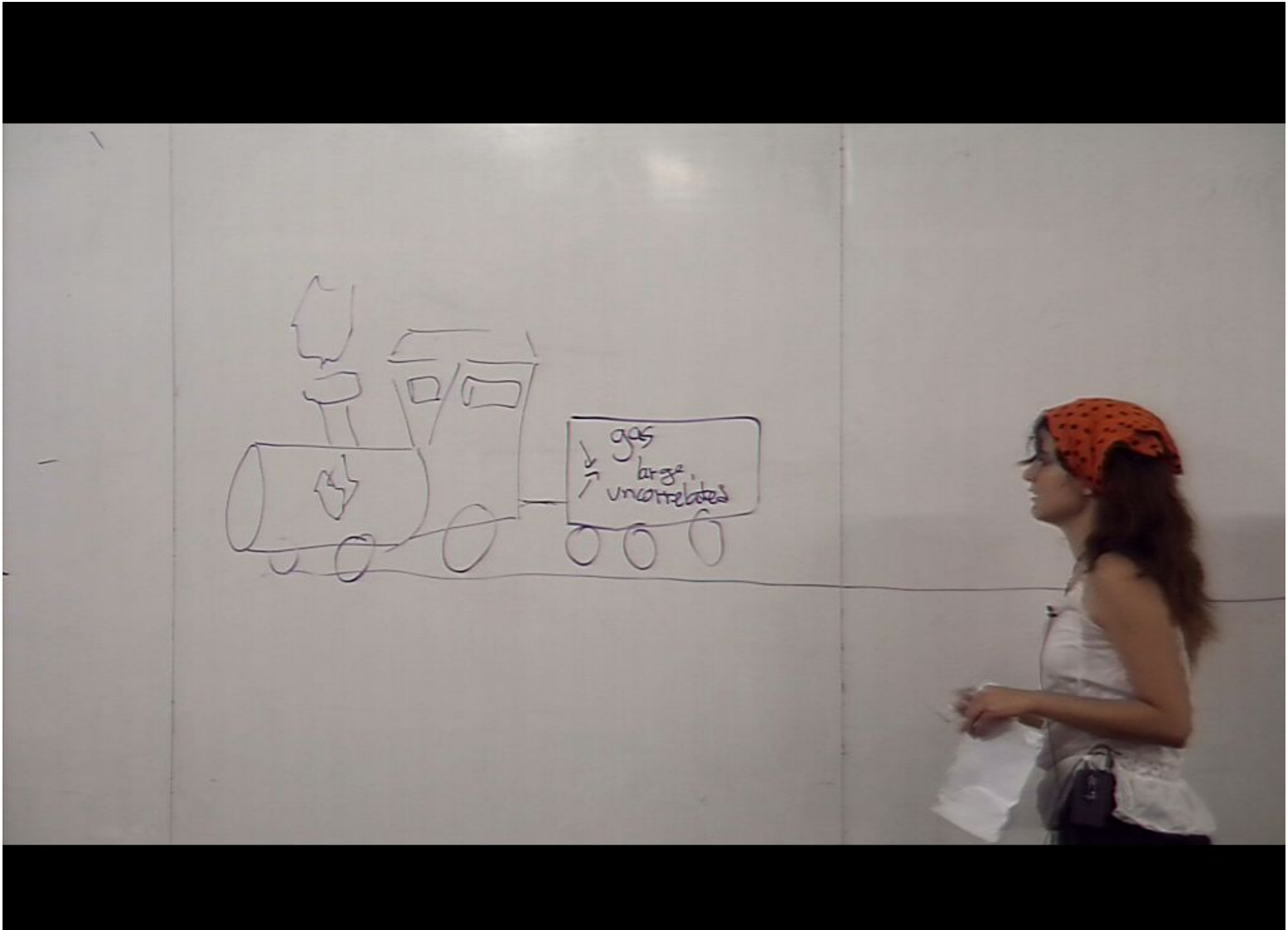
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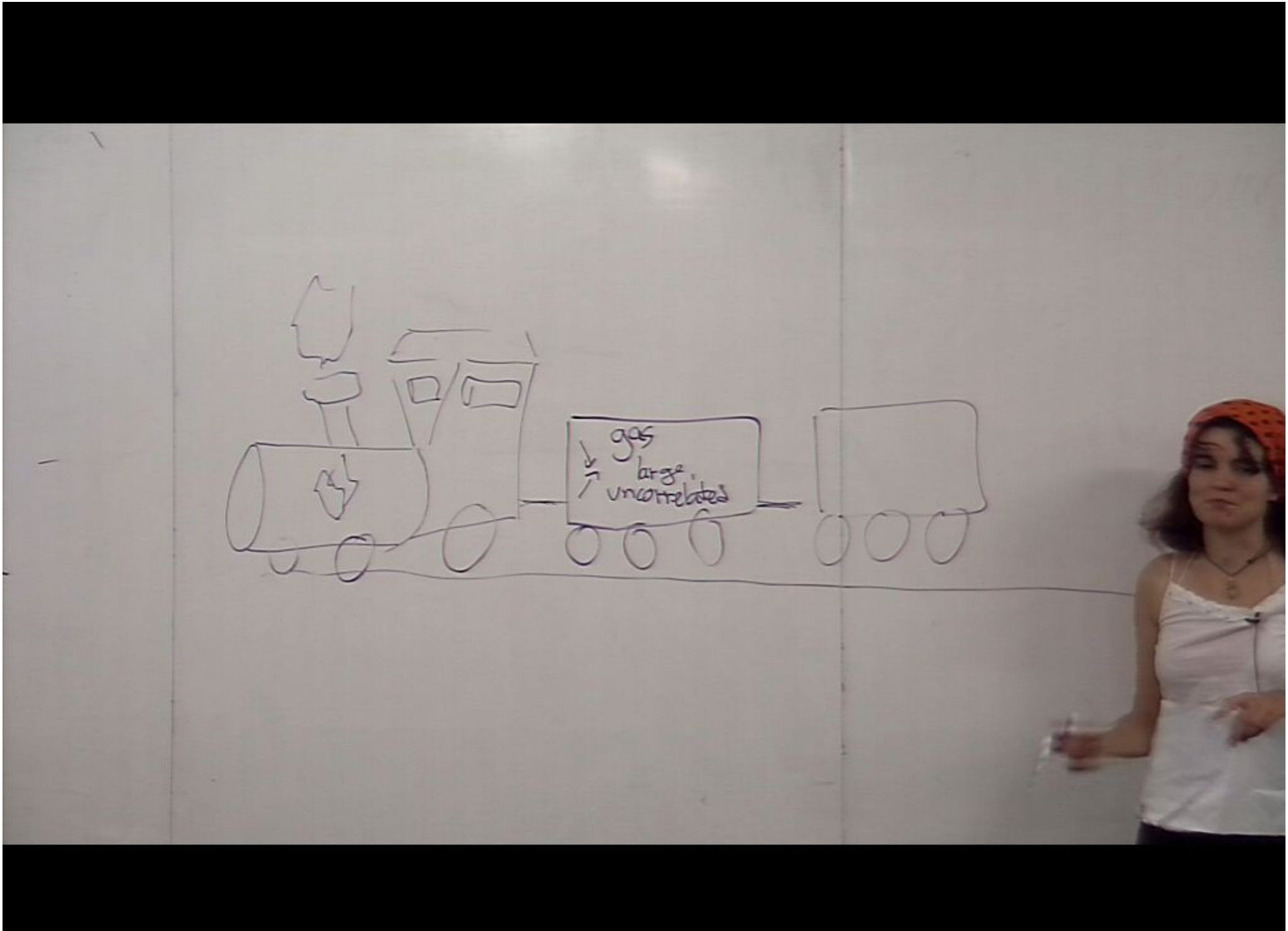
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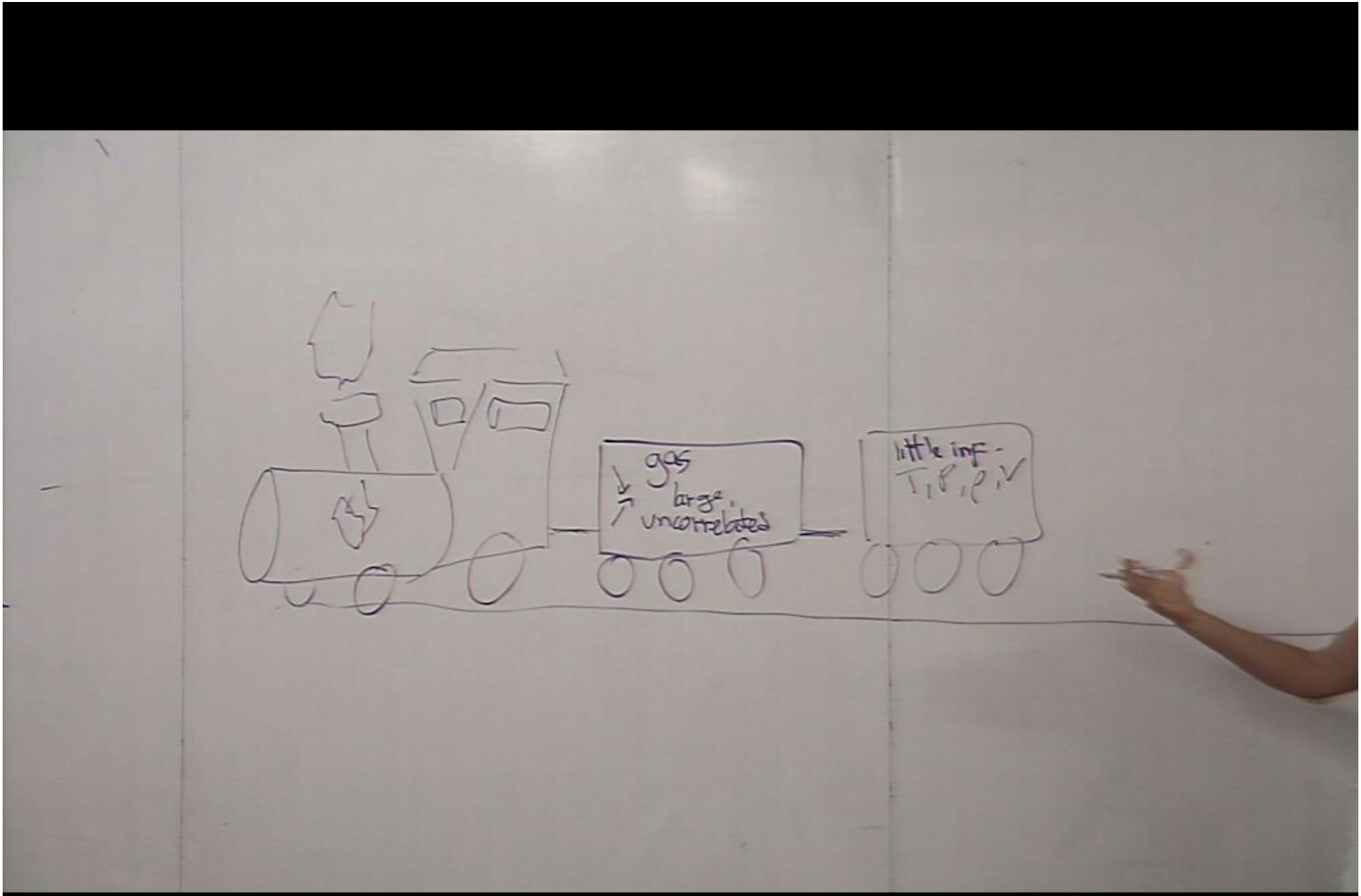
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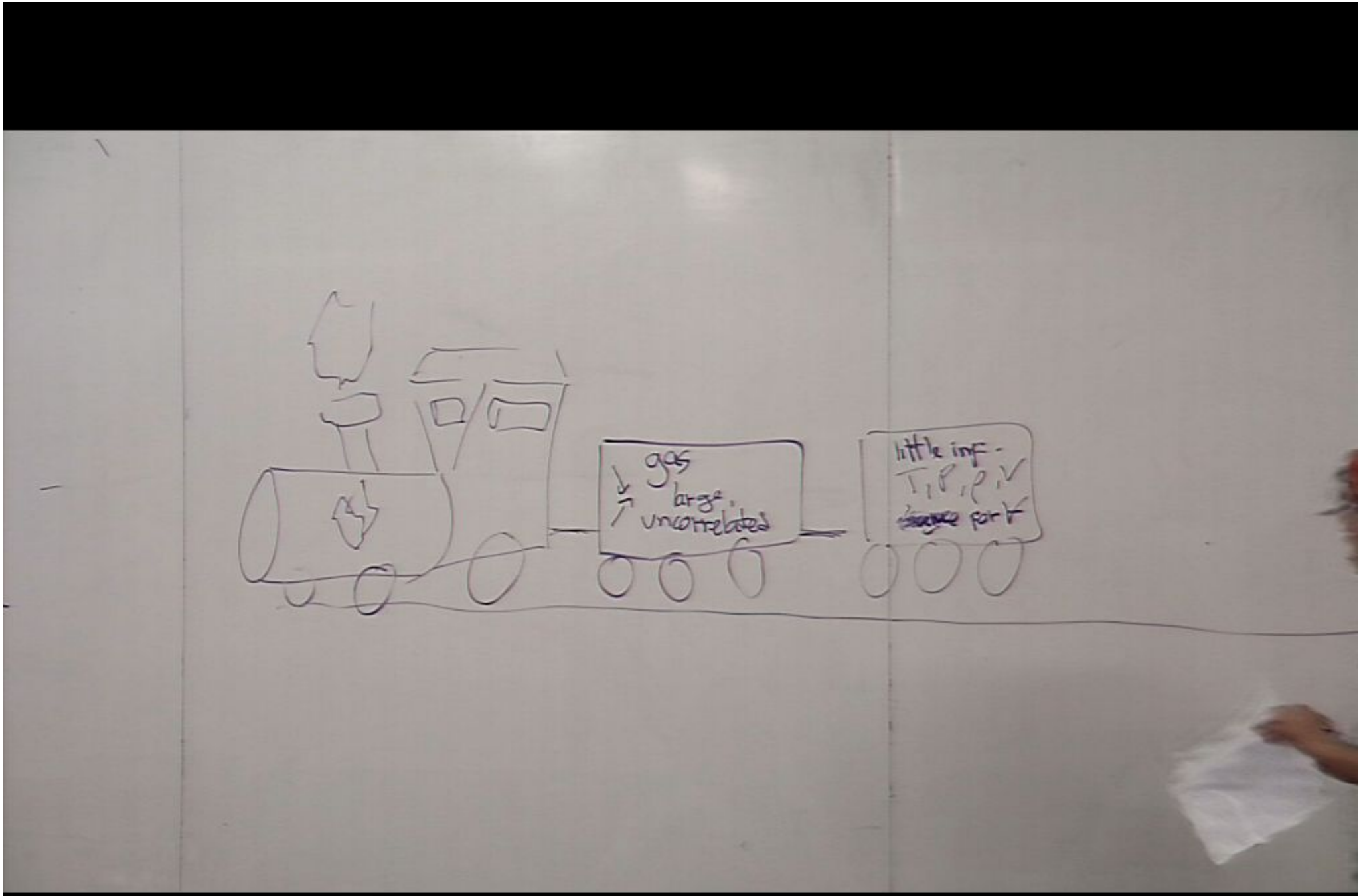
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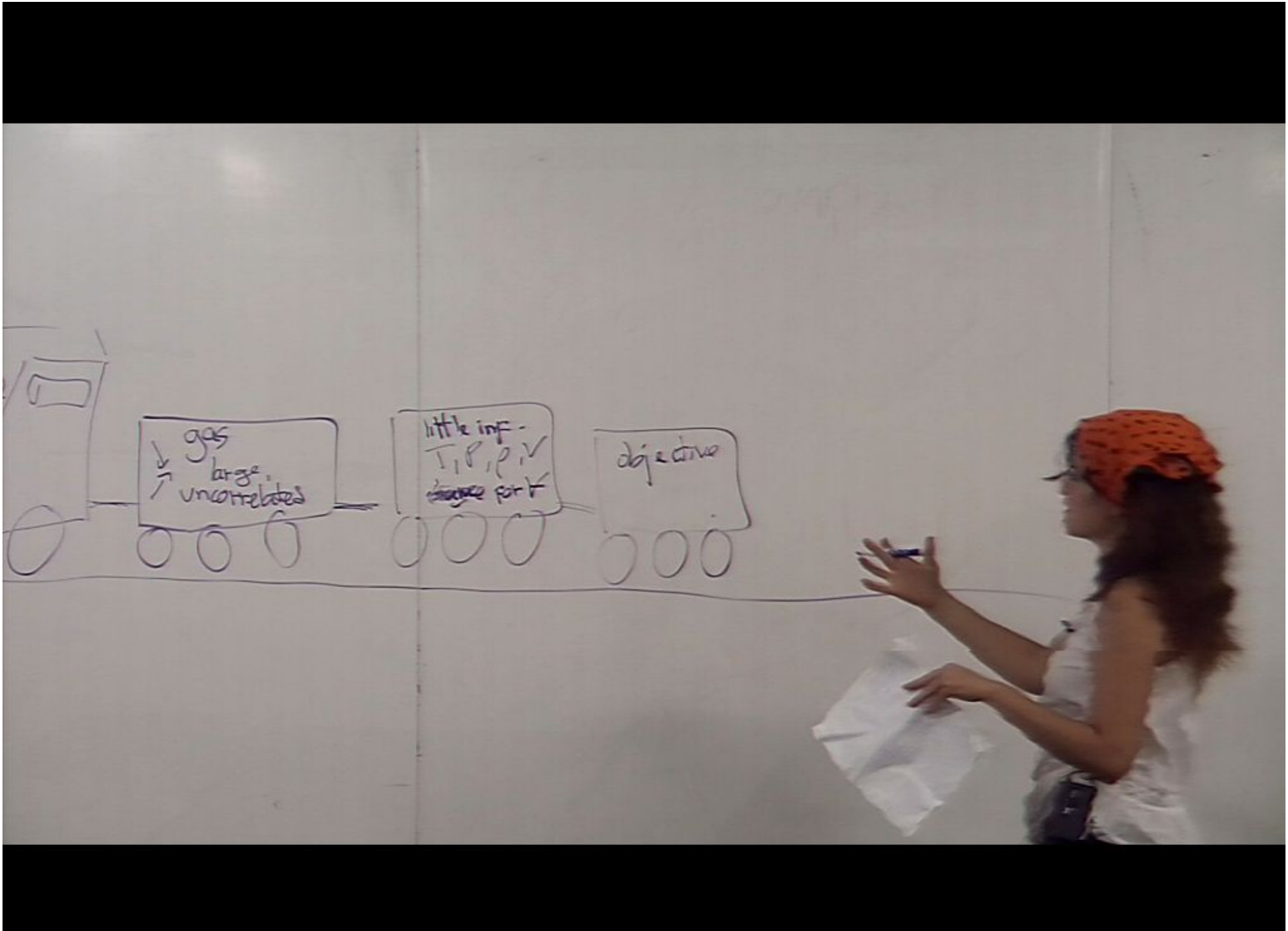
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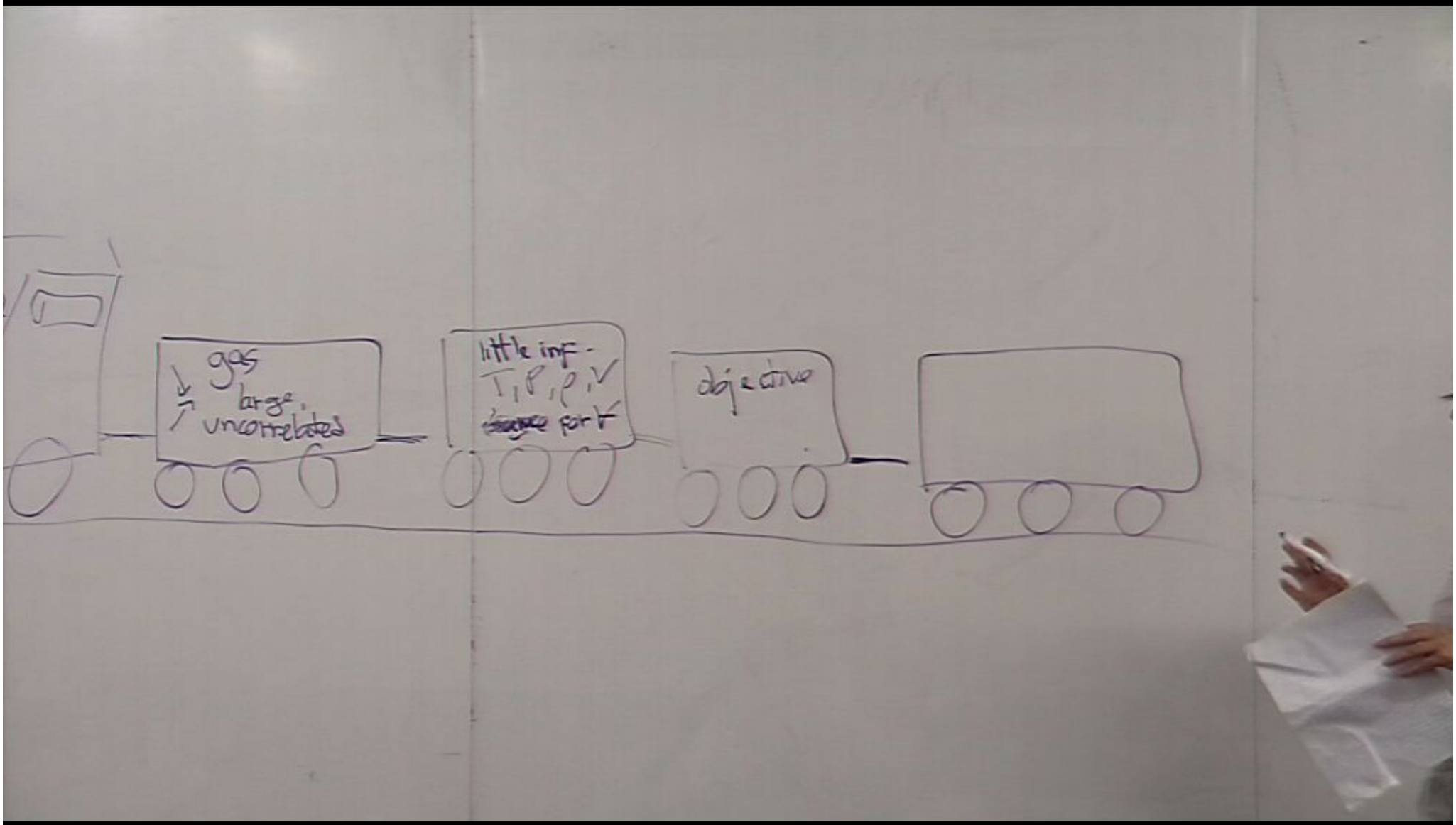
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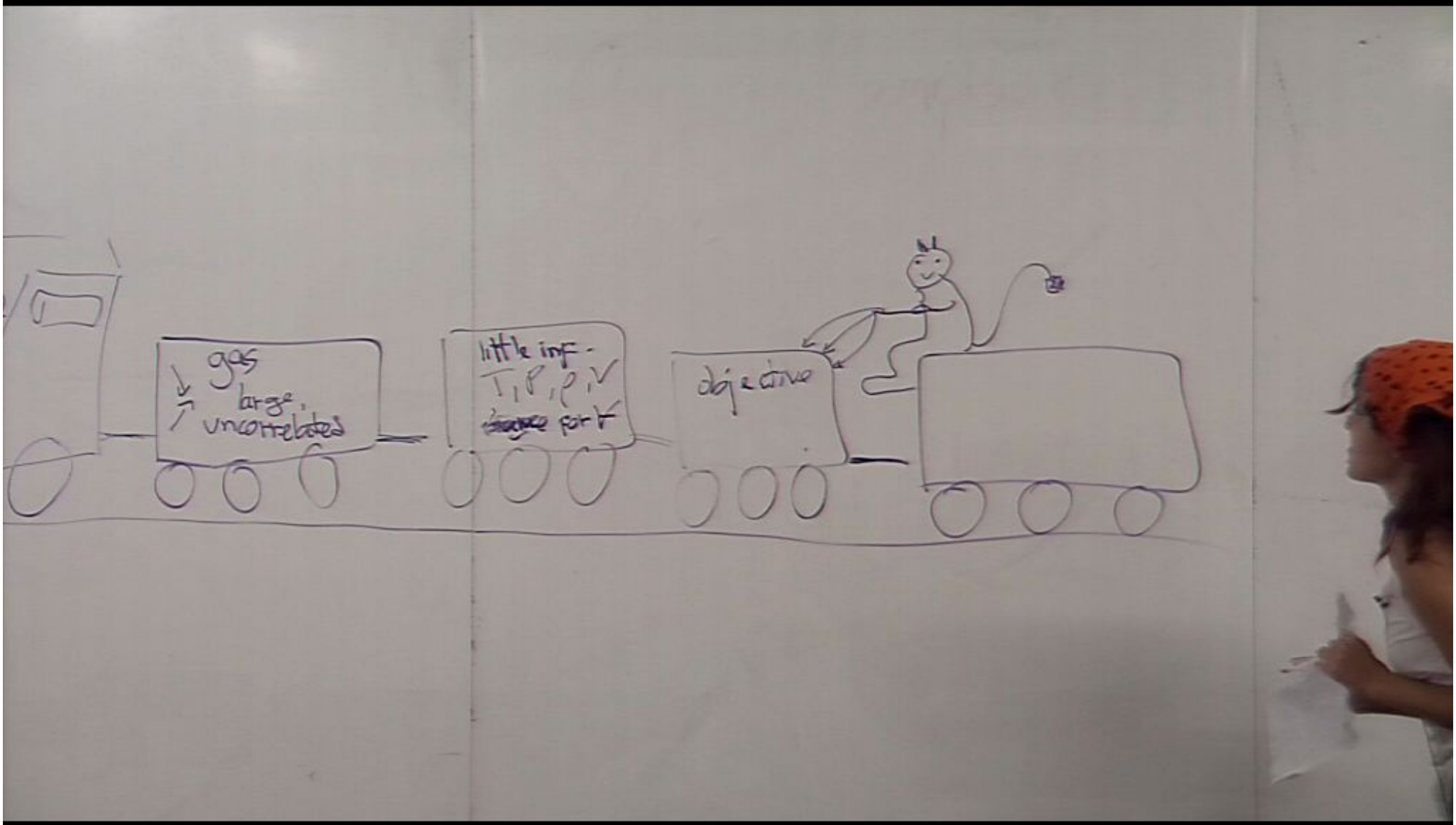
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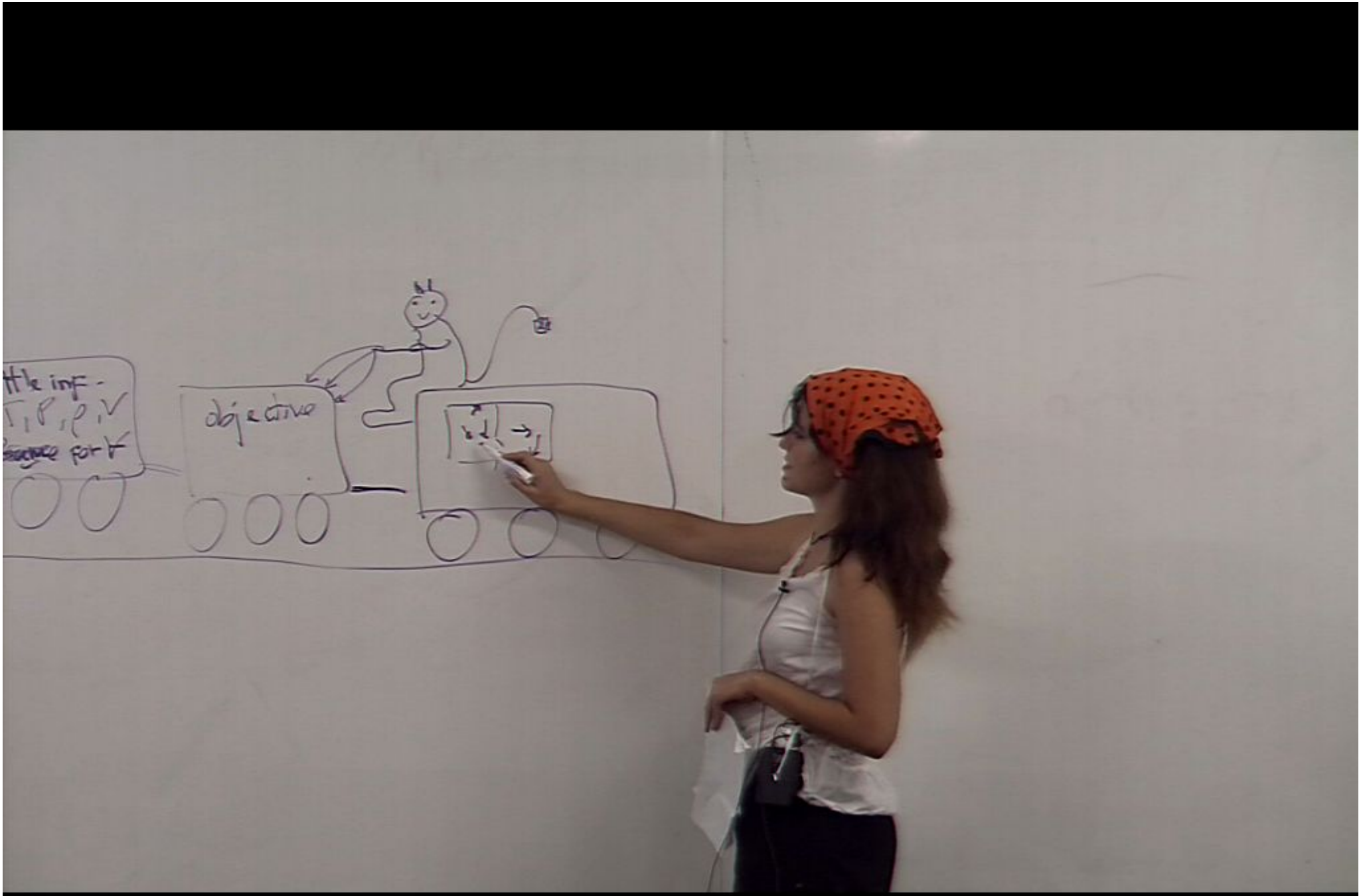
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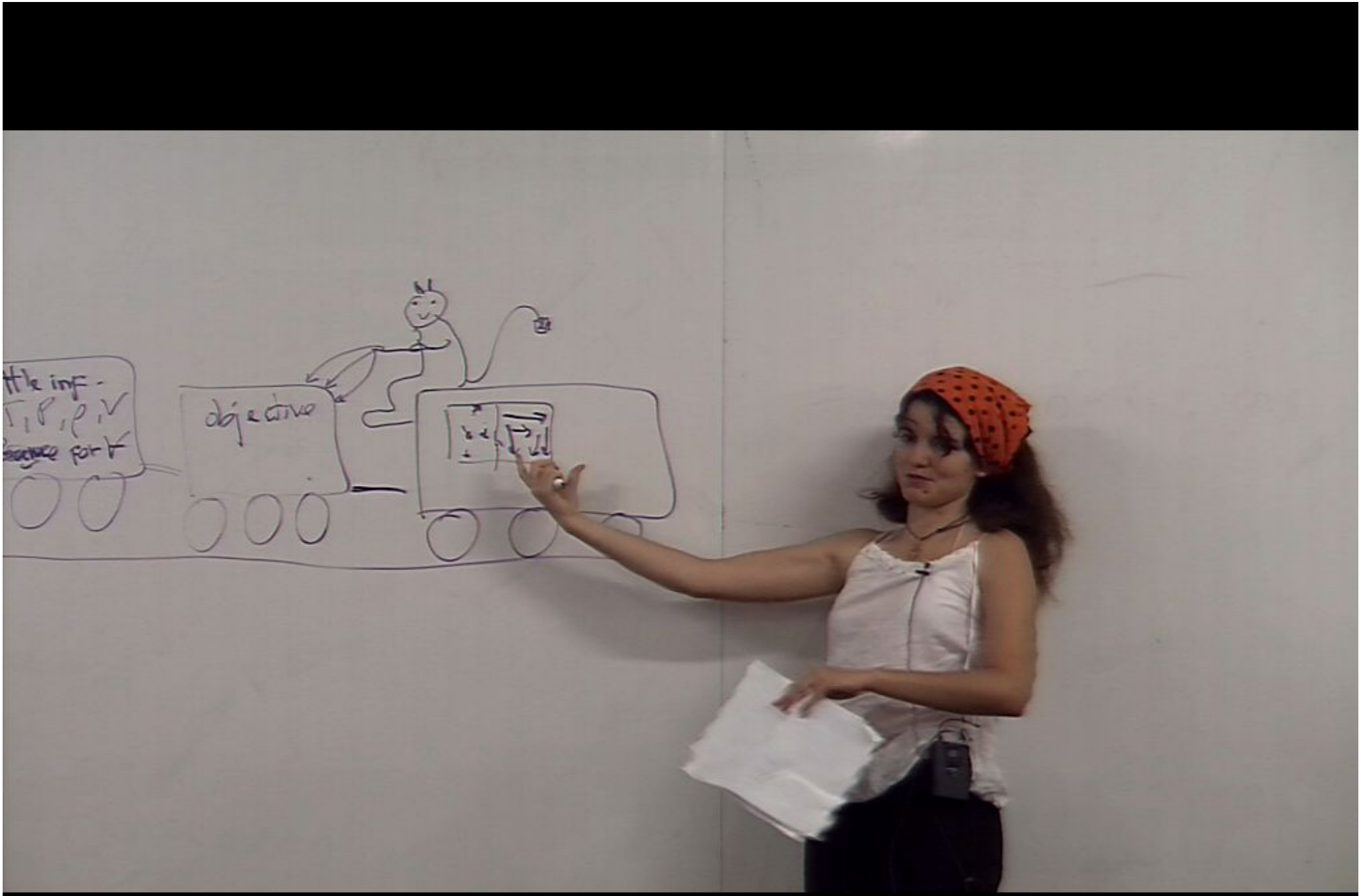
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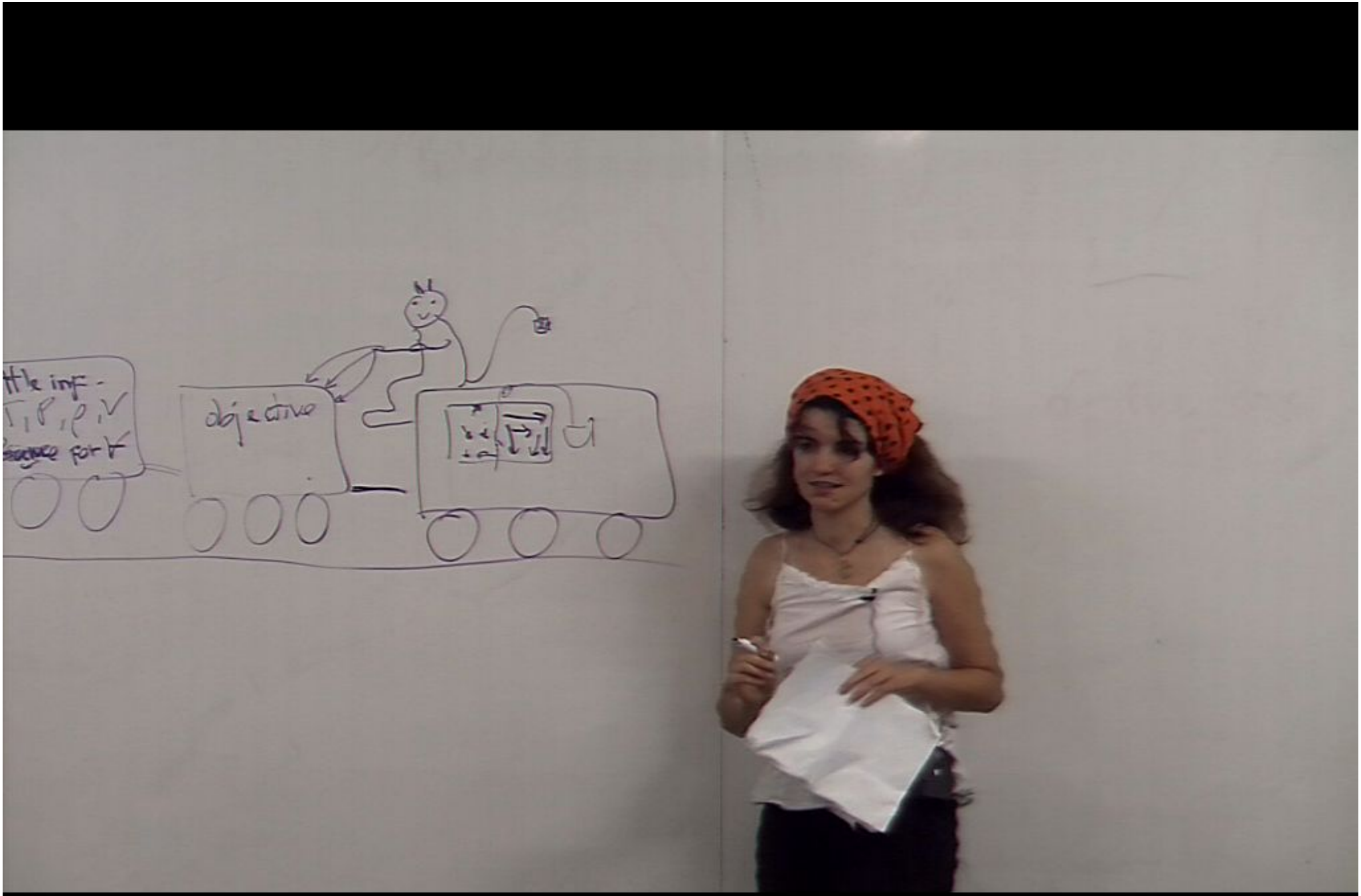
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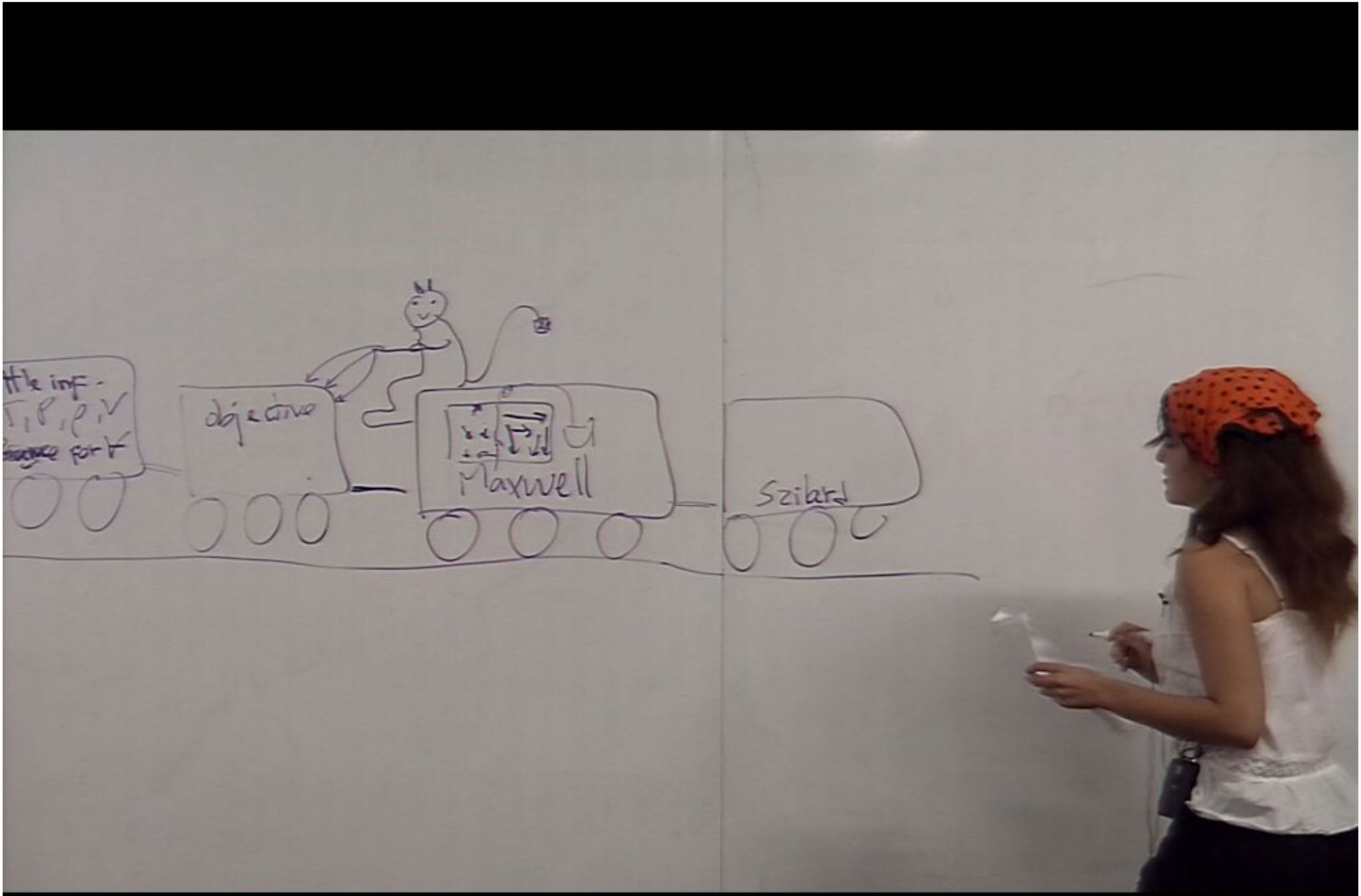
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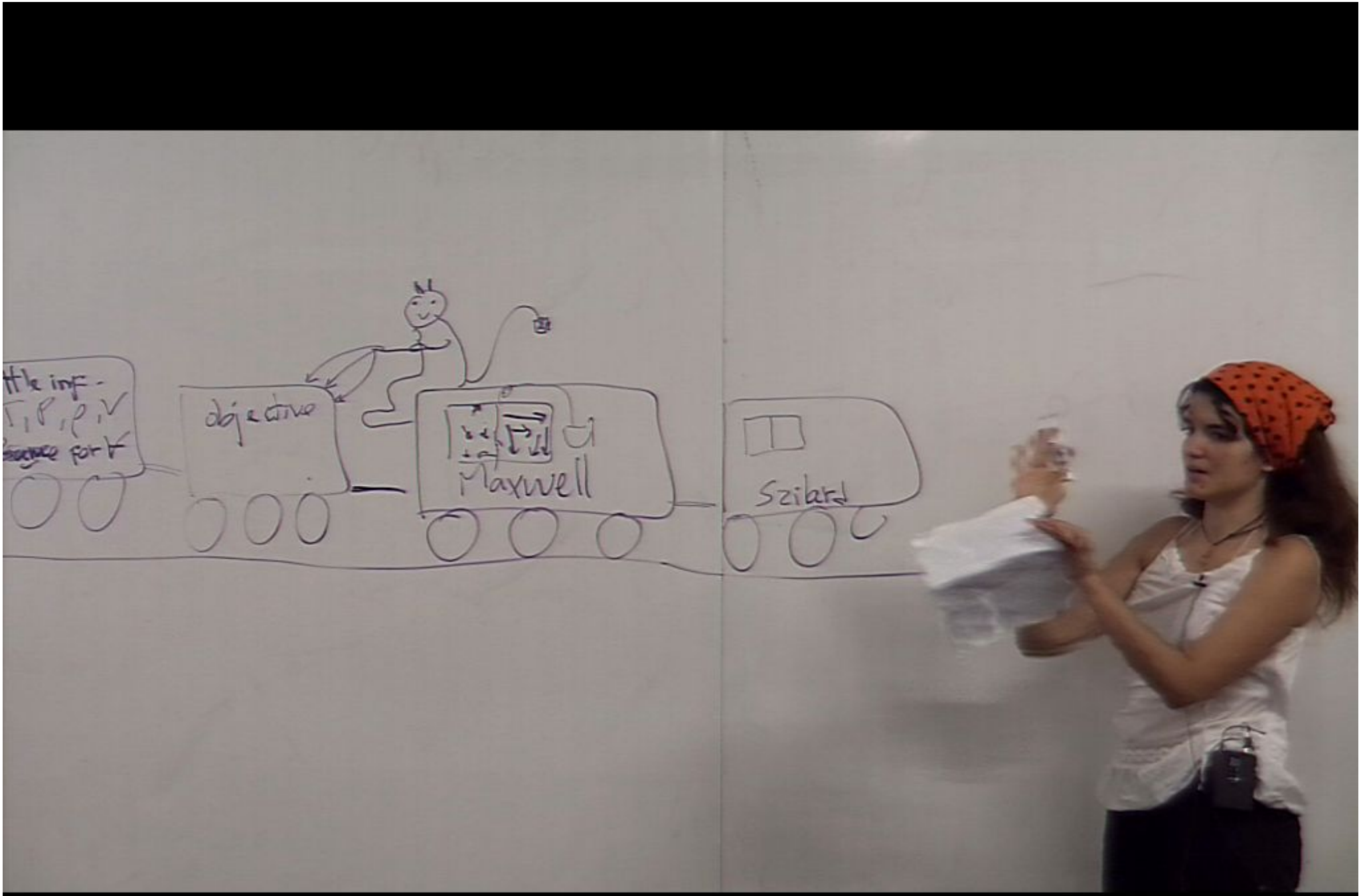
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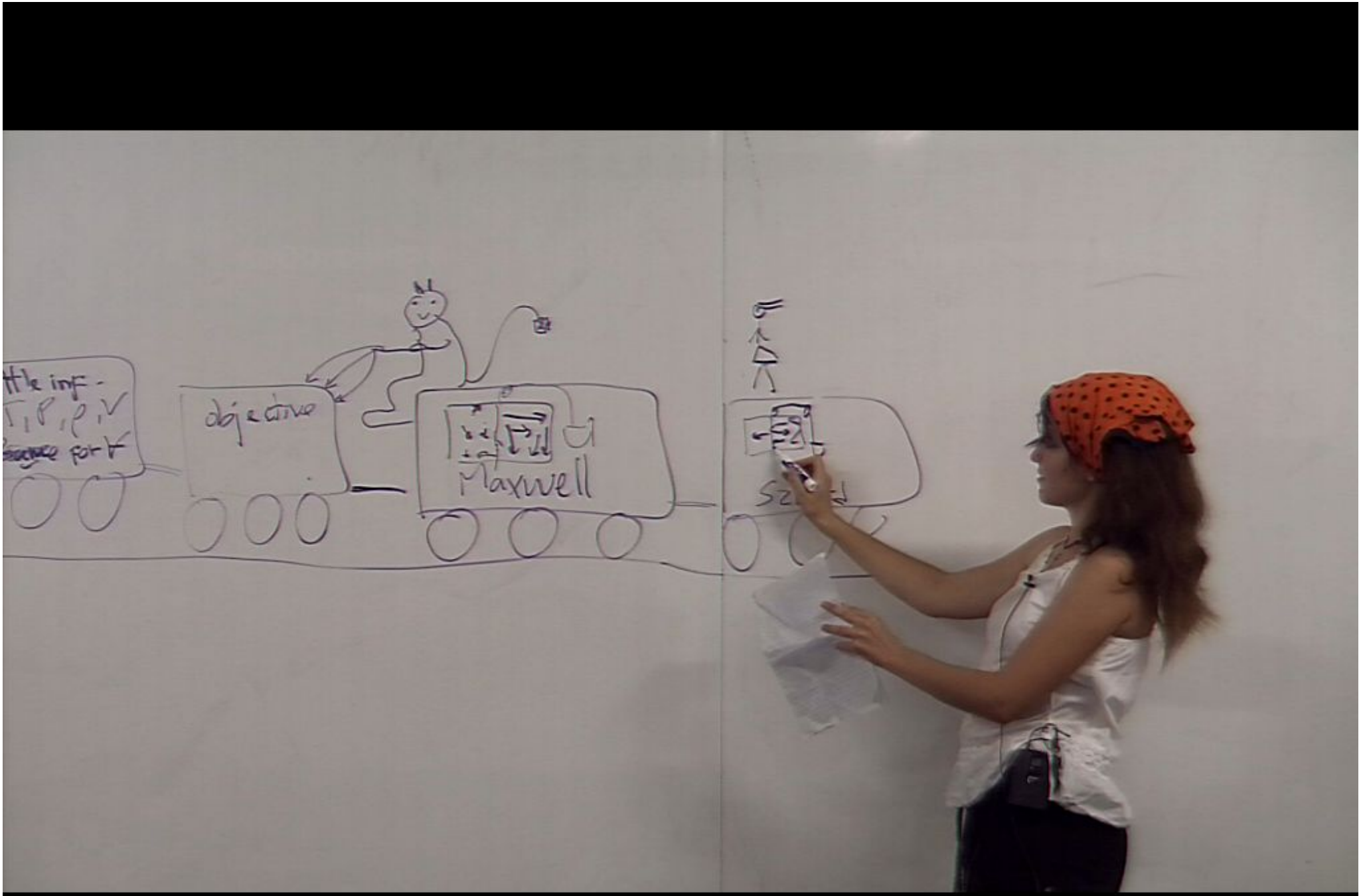
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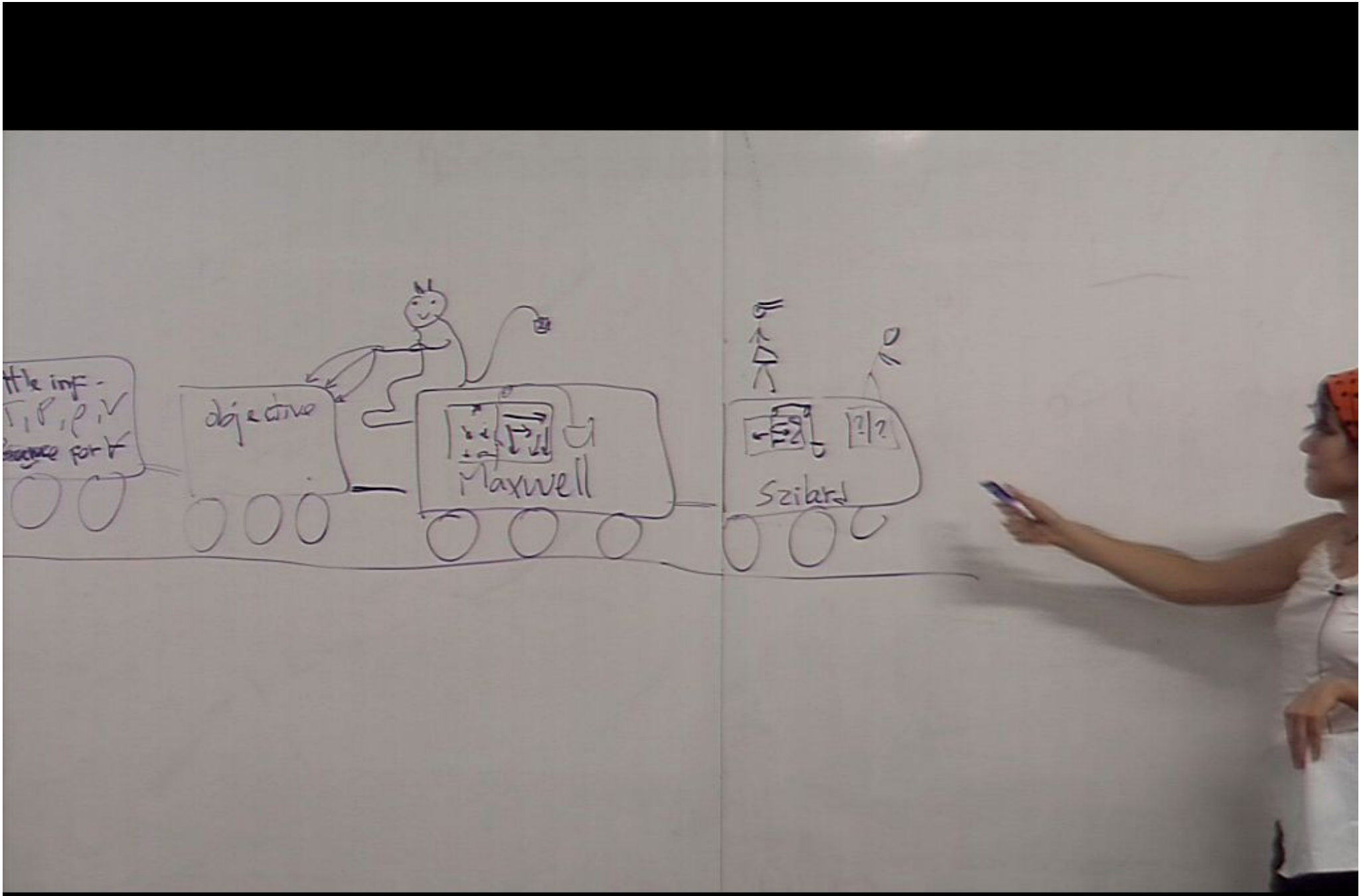
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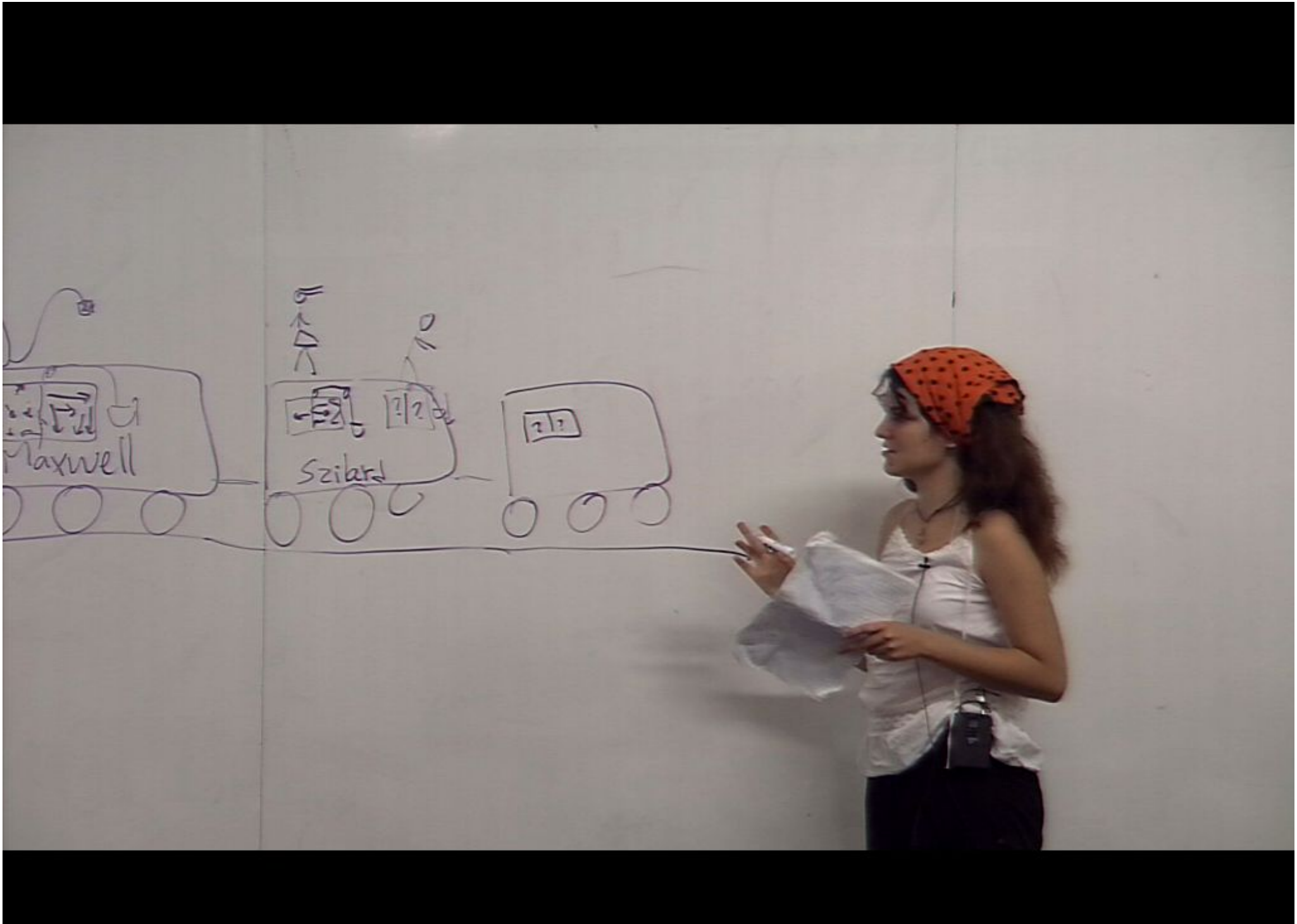
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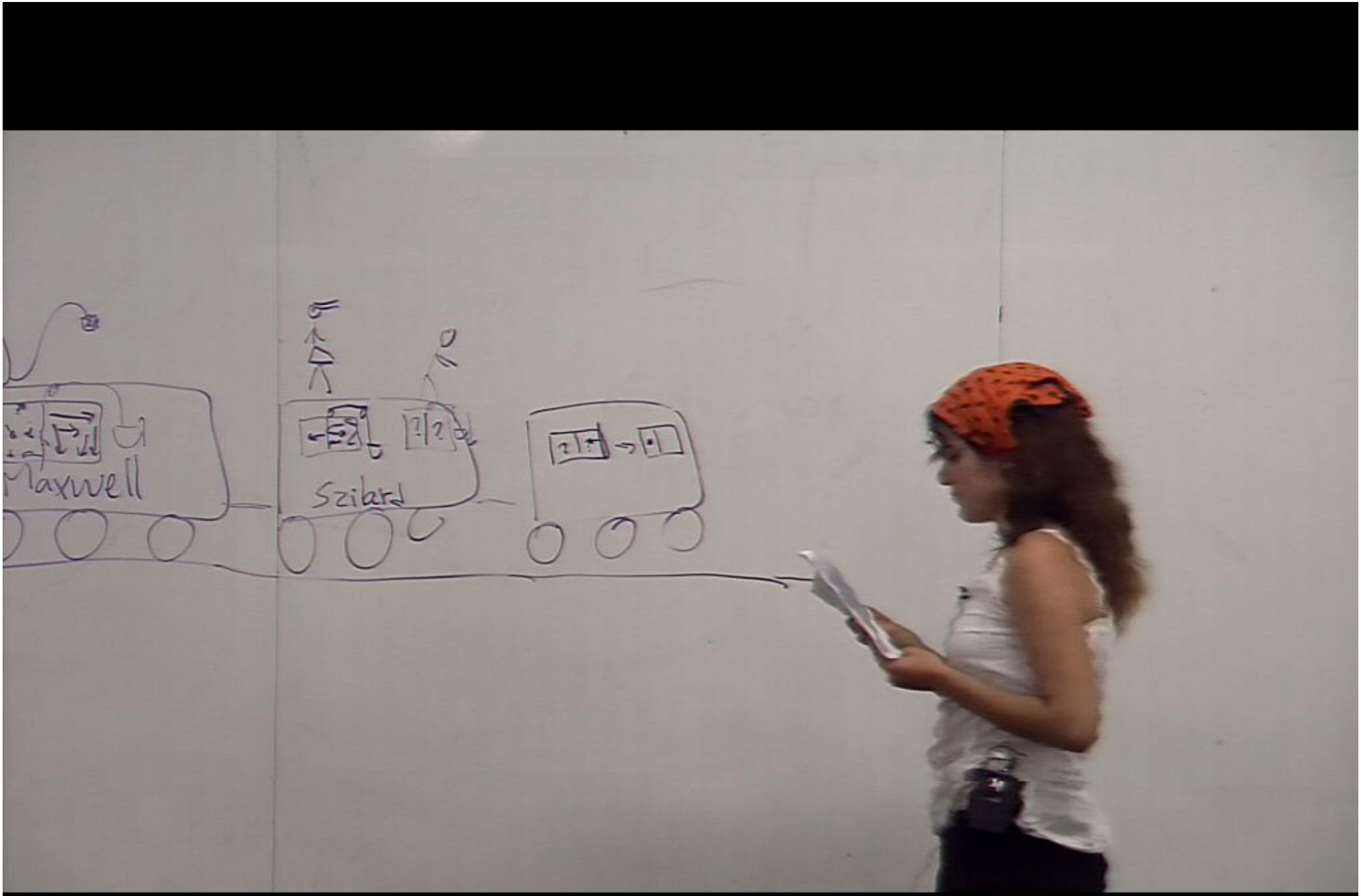
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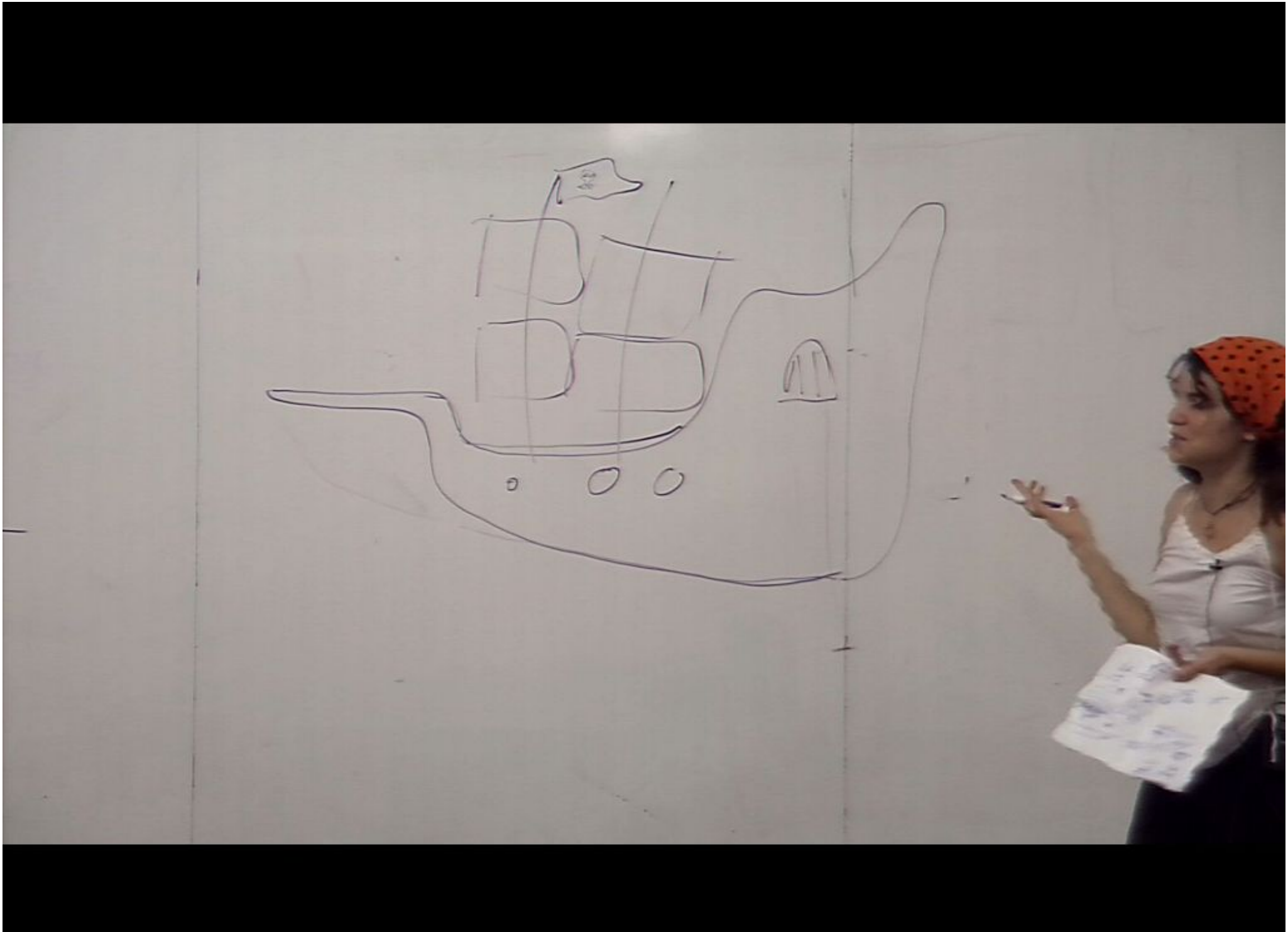

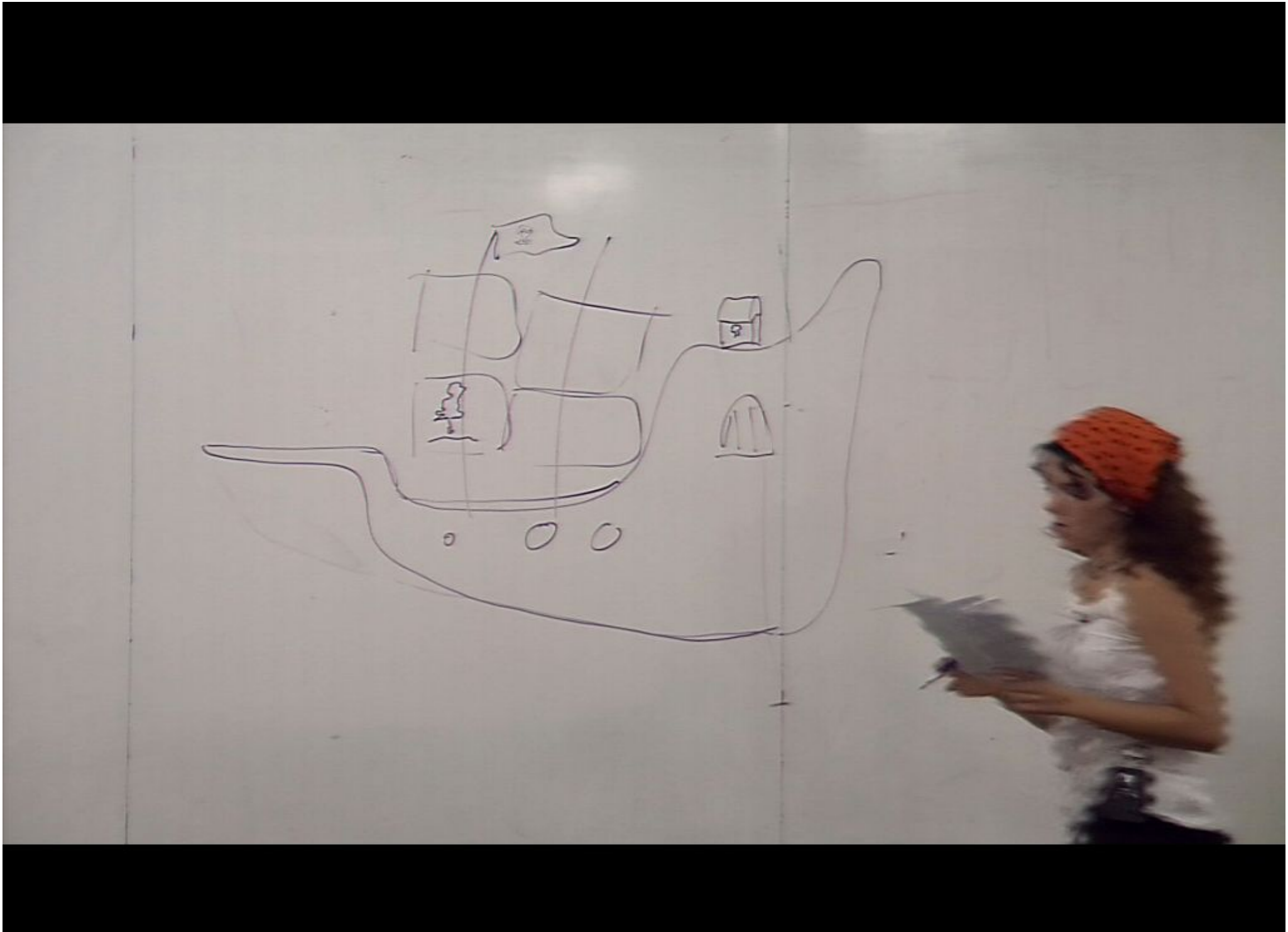

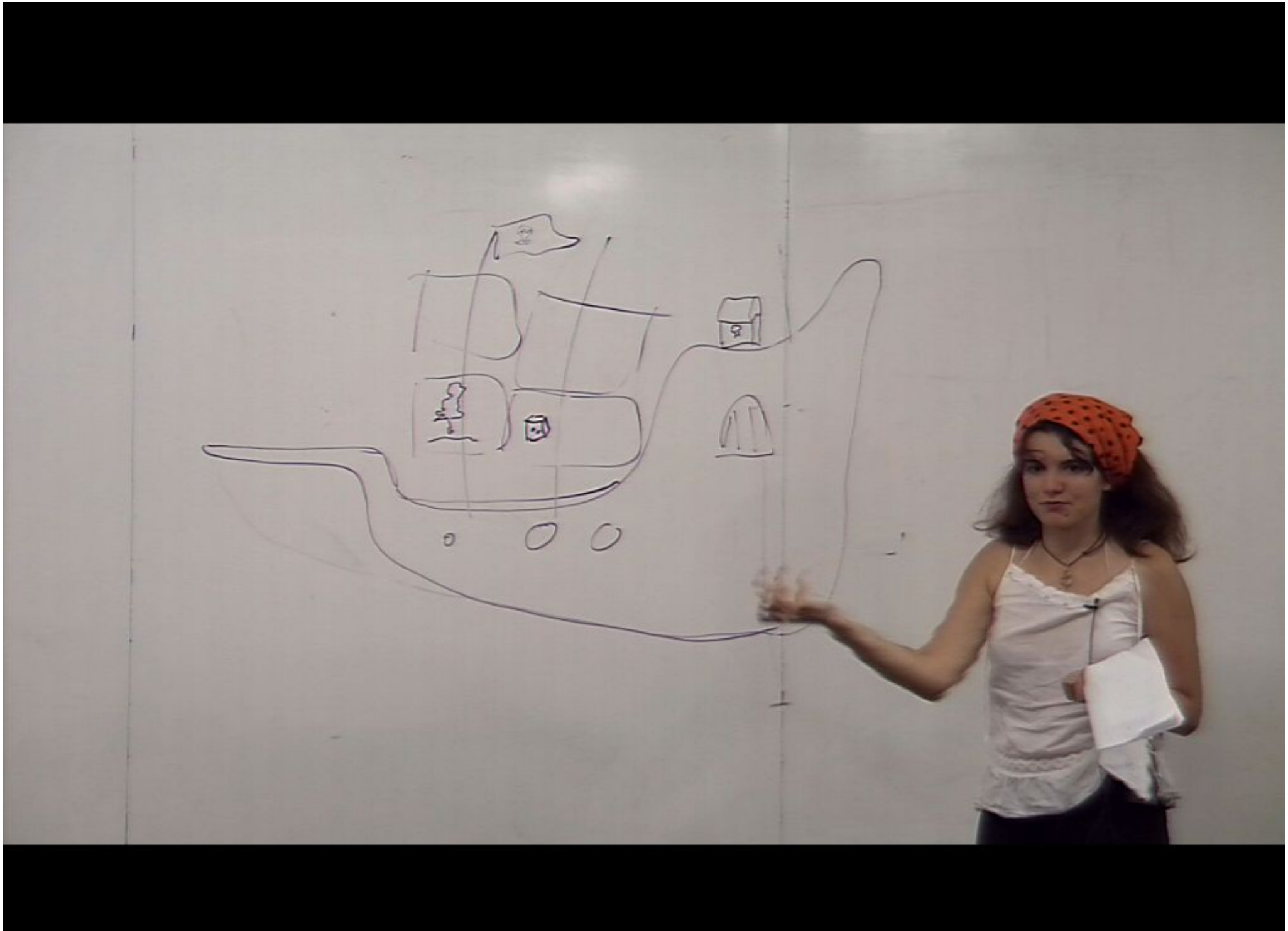

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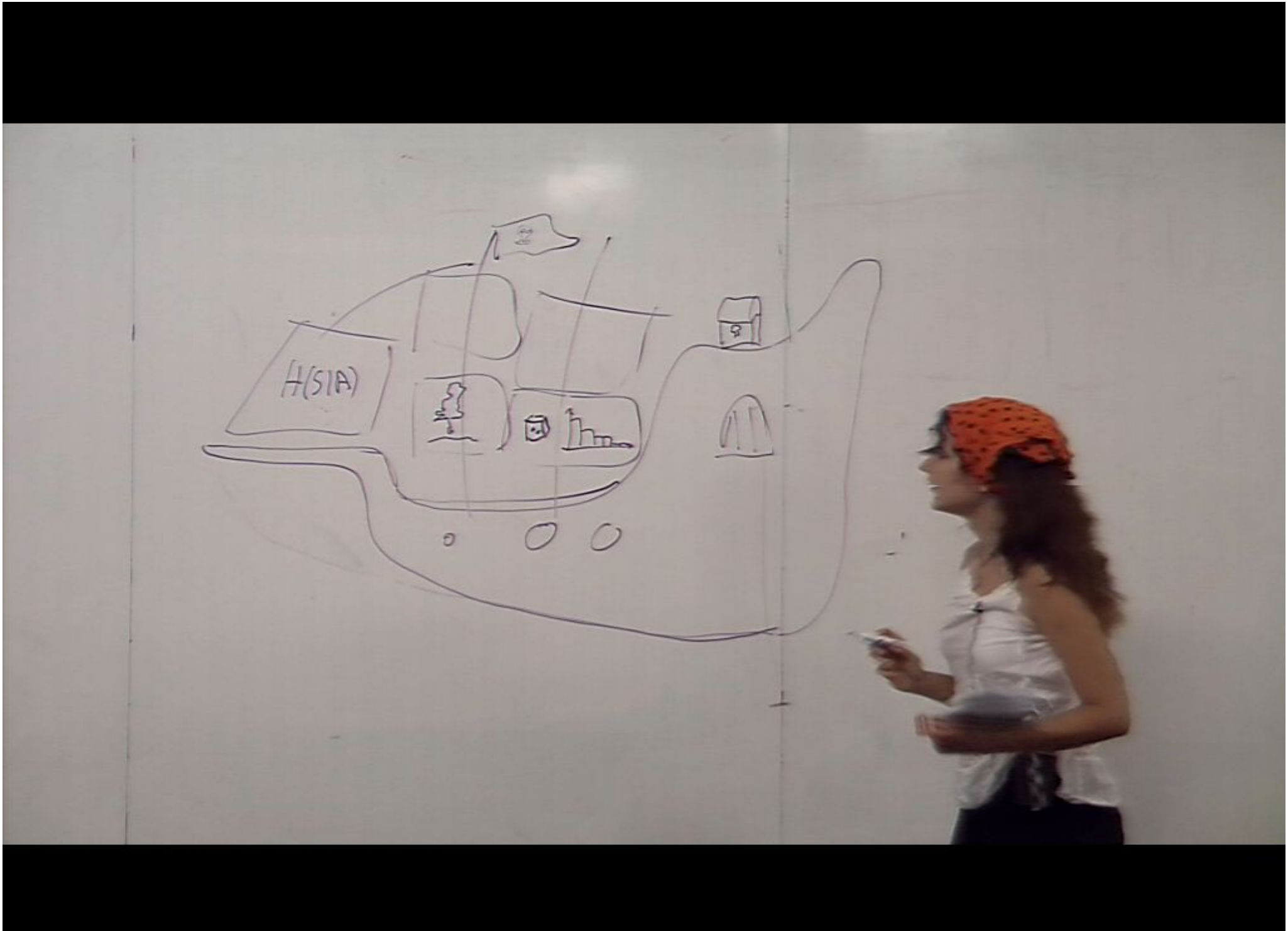
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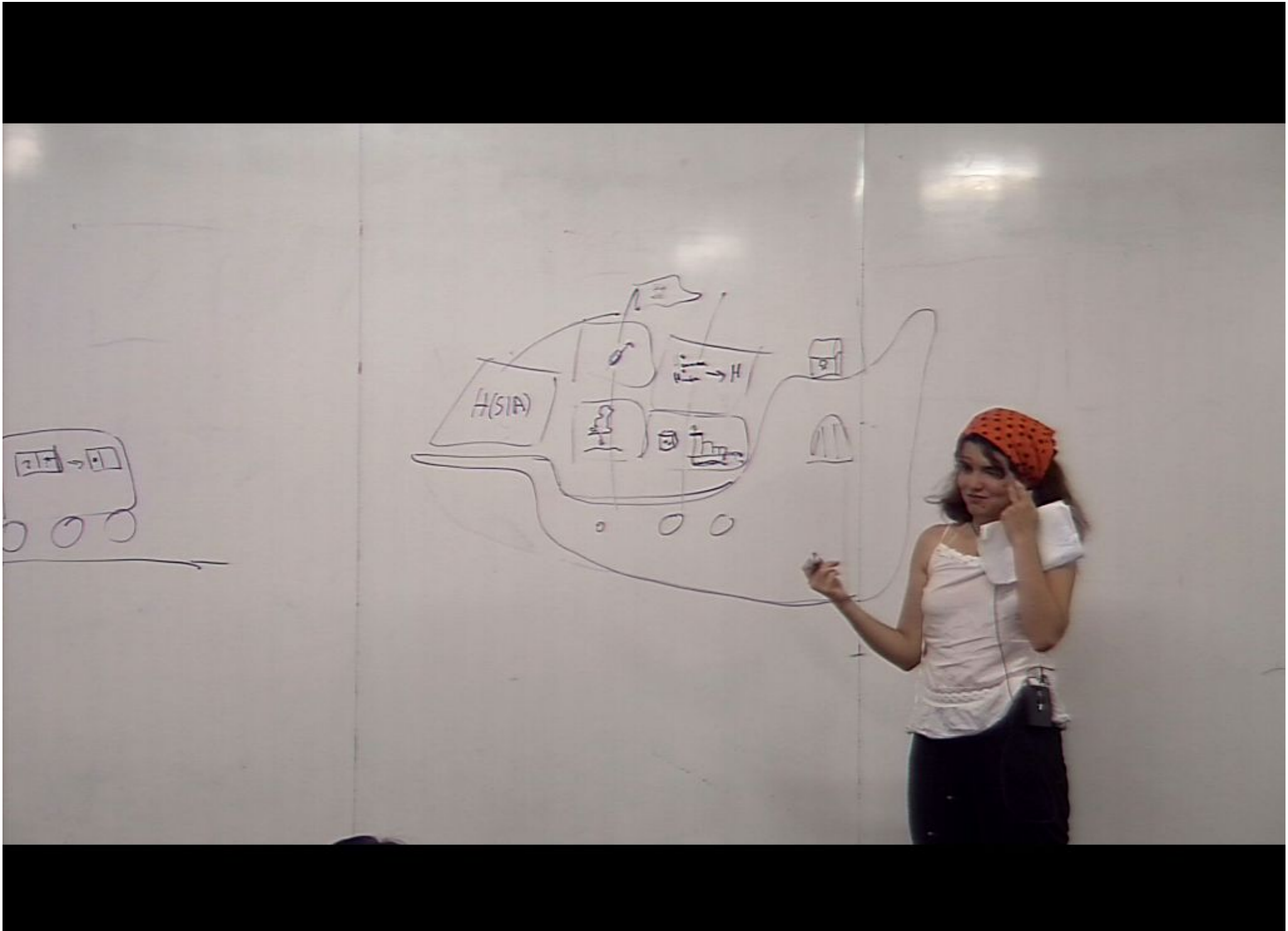
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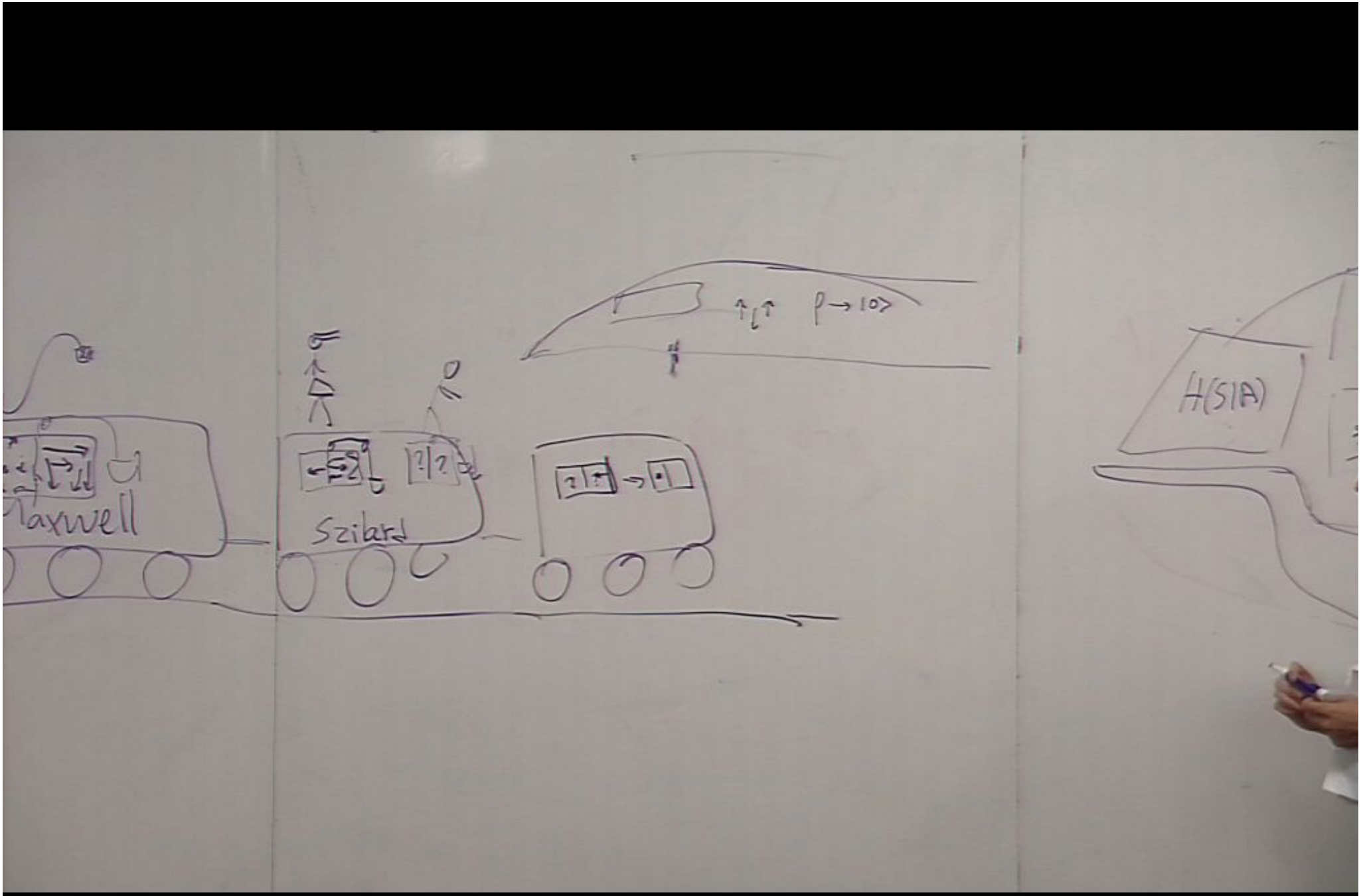
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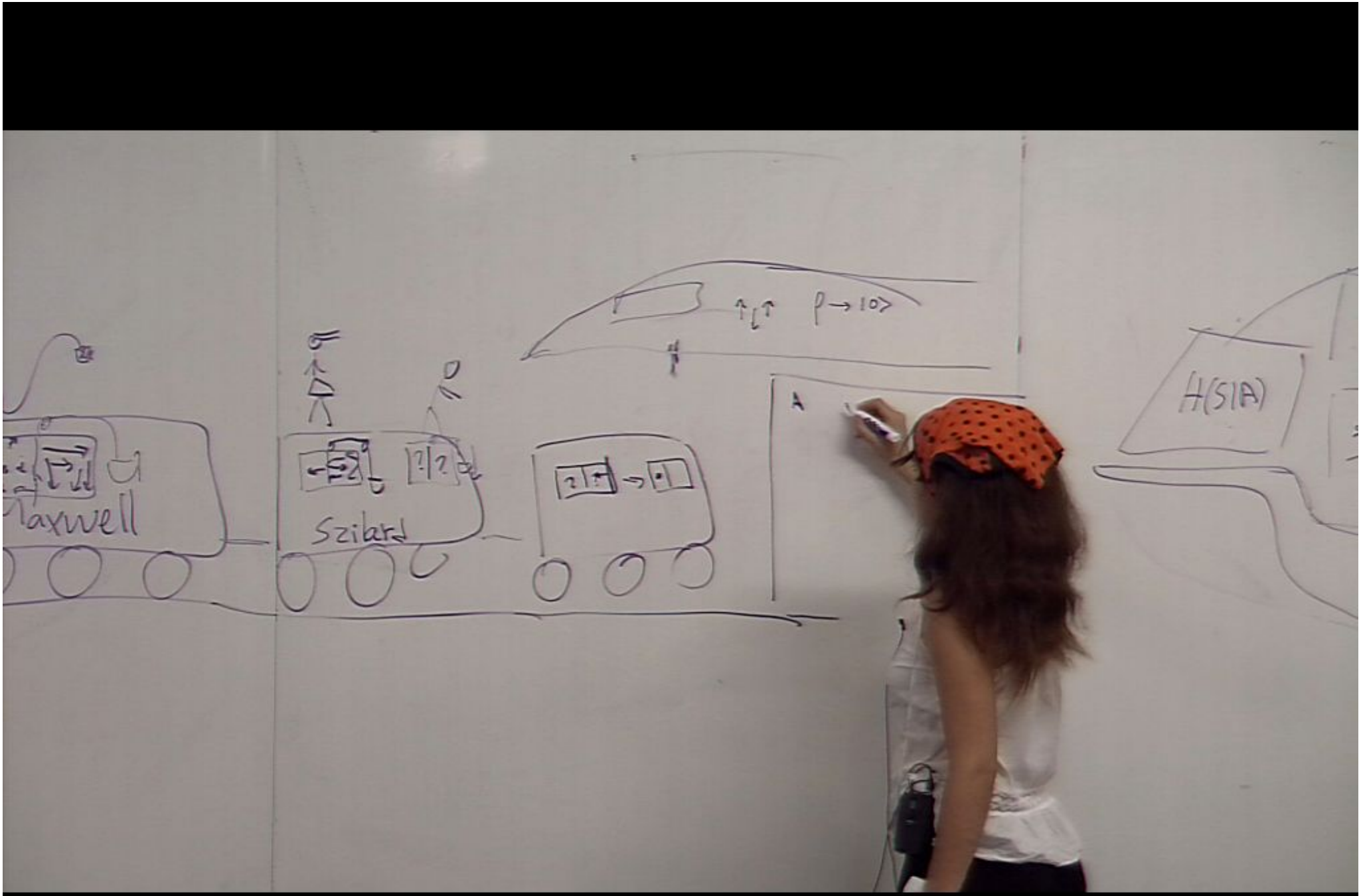
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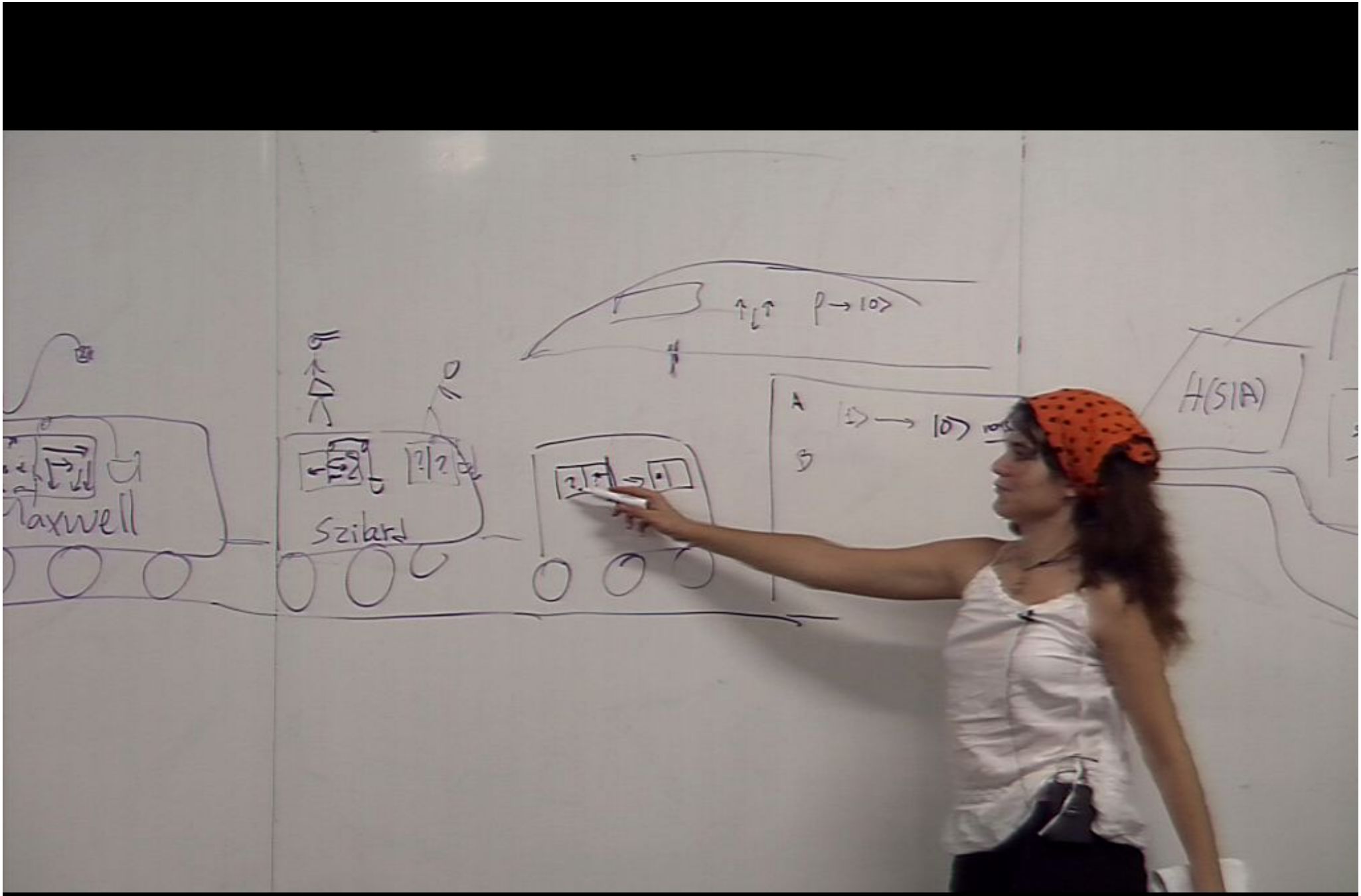
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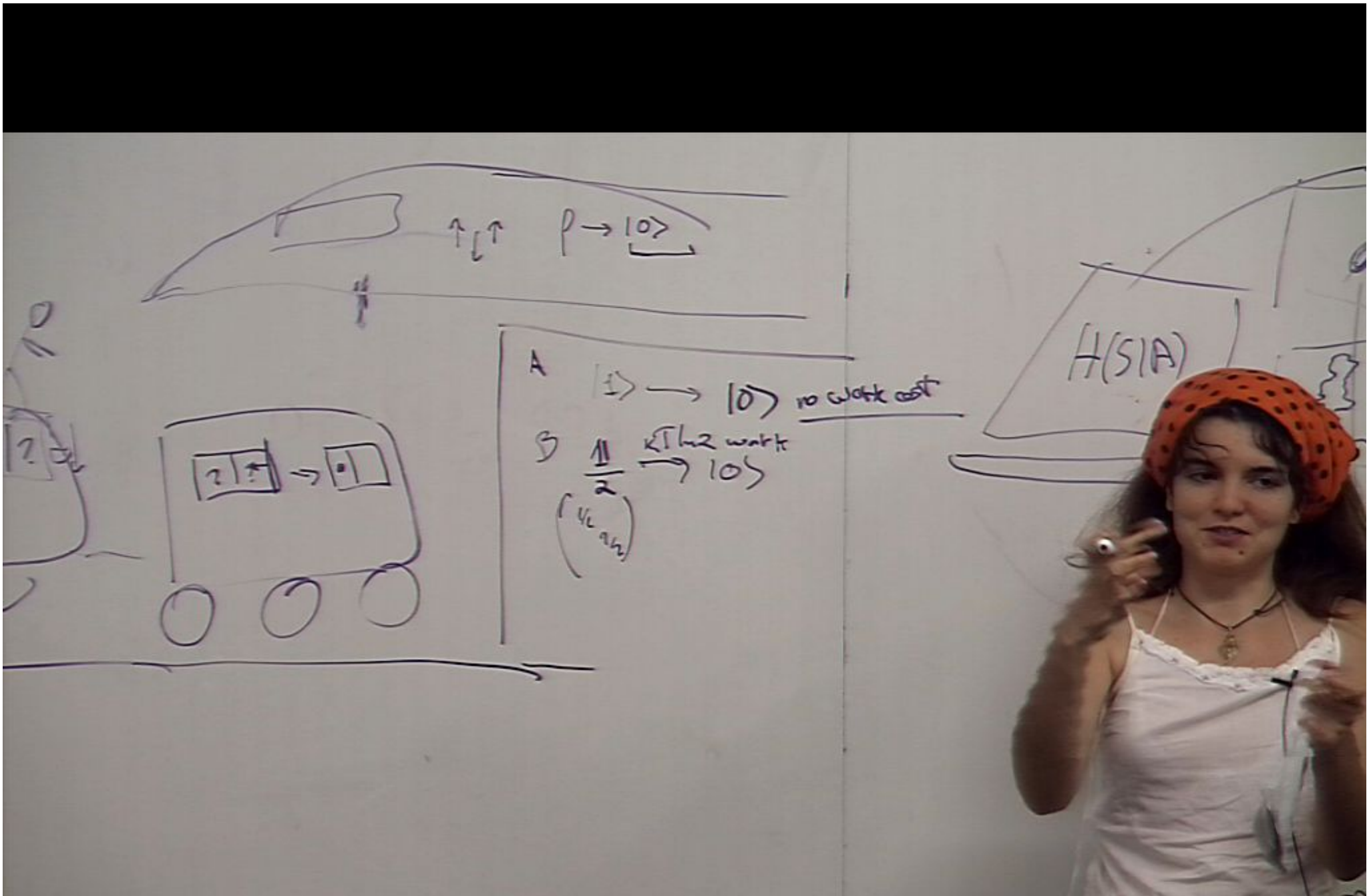

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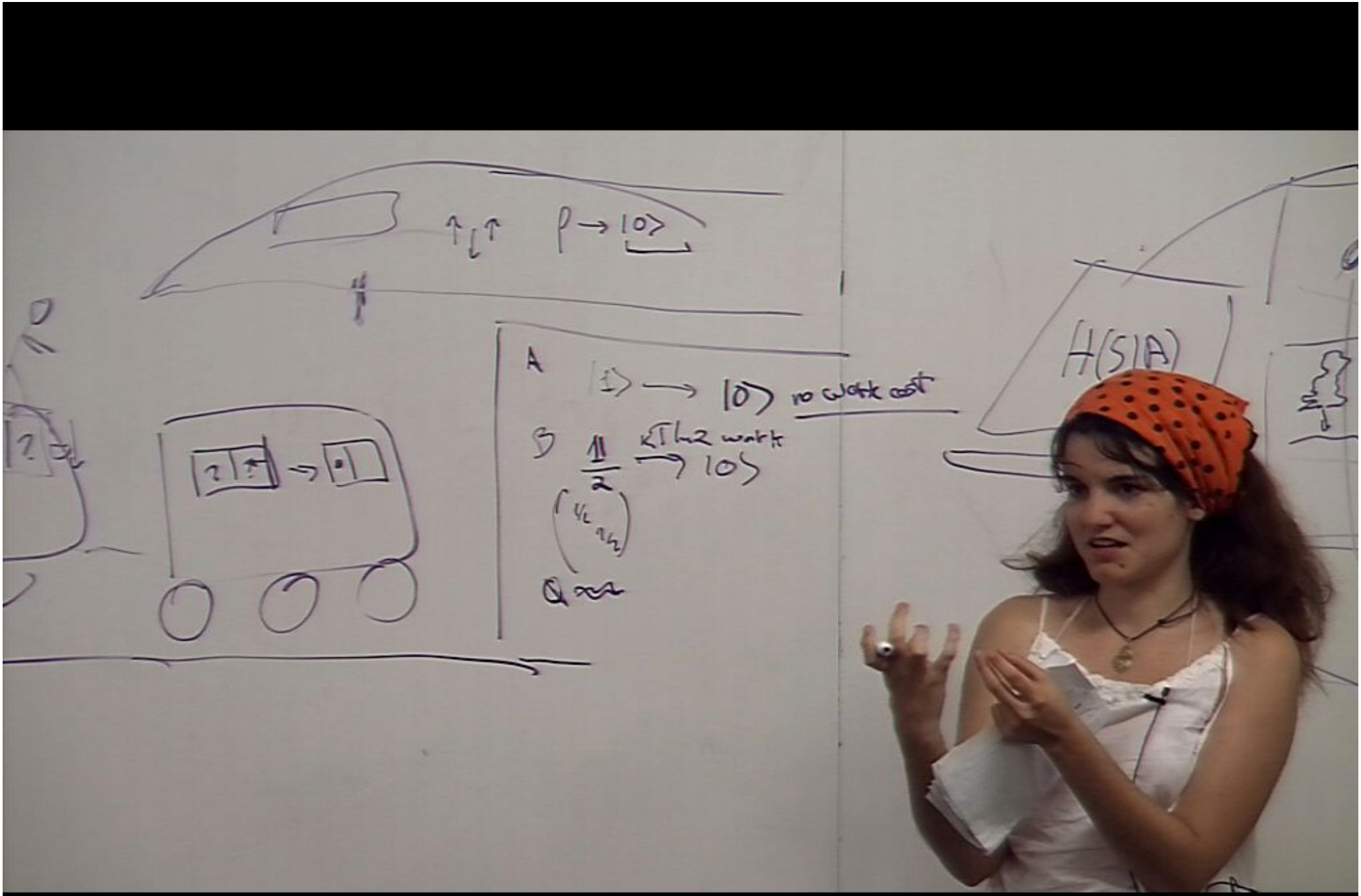

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