1 Development

diSessa tries in this section to describe the development of p-prims of naive physics into the “distributed encoding” of expert knowledge structures. I think he fails dismally.

What I do like however is that he has (I think) some very perceptive observations about the difference between novice and expert thought patterns. The questions I would like to explore are really what are the practical educational implications of these observations.

1.1 Summary of diSessa’s Observations

The basic idea is that diSessa sees “naive physics” as being described by a set of “localized” prims. Highly context dependent with a complex structure of cuing priorities. As I observed in my last set of notes, this just sounds like good old-fashioned connectionism. He also observes that experts use a similar method of p-prims to think about physical systems. The distinction is however that these p-prims ride on top of a deeper structure of physical laws which can be resorted to at any time.

He gives the example of the “sucking” primitive which serves as a surface encoding for a very complicated piece of physics about how the atmosphere pushes down on the liquid in the glass as the cause of movement of liquid up the straw. Likewise a “channelling” primitive is sufficient to encode the complexity of fluid flow up the straw. Only if you were designing an air intake for a F1 engine would you start worrying more deeply about the complexity of that flow. And as another example: and expert can use the “force as mover” p-prim as a special case of Newton’s second law applied to objects starting from rest.

The Montessori bells section and the ideas about abstracton of p-prims is a little puzzelling. The problem of the bells is solved by deciding which of two “primitive” effects dominates: namely which of “more massive means slower vibration” and “thicker means stiffer means faster vibrations” wins out. diSessa suggests that an expert will see both of these effects through the application of simple harmonic oscillator intuitions (I am not sure I am correct here . . . diSessa later questions whether the harmonic oscillator is cued at all and then suggests that p-prims are cued in a context free sense which is just plain wrong . . . ) and resort to deeper calculations to see which effect wins. But does he really have any data? If you read the last AJP, there is an article by Singh in which she presents supposed experts with just such a problem and apparently most of the experts clung to one of the “primitive
intuitions” rather than seeing both and trying to decide which effect wins or whether they cancelled each other out.

In typical diSessa fashion, the section on agency and Newton’s third Law is just obscure. It did however trigger some interesting ideas in my mind and I will put them down as questions/discussion topics for our meeting.

1.2 Questions

1. diSessa suggests that there is a causal syntax often applied to intuitive physics. Most interestingly (for me) he (correctly) observes that Newtonian mechanics is a particular point of view chosen because it fits very well (for the most part) into this causal syntax of agents, effects and patients (things being acted upon). What really got me thinking was the often occurring idea that passive objects cannot exert forces (tables, walls etc). Does this not stem from the way physicists talk about forces? Namely we like to say “objects exert forces”. This phrase implies first that the object is in some way animated (ontological metaphor again!) — hence it is obvious to conclude that objects which are visually inanimate (like tables and walls) should not exert forces. Secondly “objects exert forces” suggests force as a commodity which the object possesses and “gives” or “provides”. What do you think of this analysis? Does it have any relevance to how we teach? Must we talk better or can it work if students invent the coding for themselves?

2. What is the lesson behind the Newton’s third law discussion? What is diSessa trying to prove? He observes that N3 does not fit nicely into the causal syntax characteristic of Newtonian mechanics. He notes that it generally is encoded first as a “slogan”. A good distributed encoding of N3 means the suppression of many naive p-prims and he makes an extremely vague statement about a “shift towards seeing geometry as playing a causative role.” as important in bringing about a shift in encoding. But what is the point? Is there anything useful here?

3. I am going to raise here a broad question for discussion. I do not wish to be dialectic about it, but I will present first two viewpoints on what learning is. The first viewpoint is that learning involves the acquisition and assimilation of knowledge. This view suggests transmission style learning, development of schemas through cognitive conflict or maybe “hands on” activities, restructuring of primitive concepts and so on. The second theoretical perspective is that which views learning as a dimension of social practice (Lave and Wenger and others). This in turn implies the concepts
of peripheral participation in the practices of physicists on many levels. For example engagement in hypothetico-deductive reasoning as a tool for knowledge generation. (ie: the social practice of learning as physicists do it.) I would suggest too that it involves participation in another sense as learners become involved in the linguistic structures of physicists, ie: “talking physics”. This in turn may be mediated by hypothetico-deductive reasoning in order to be productive.

Can we have a discussion about how these two theoretical viewpoints may influence and facilitate (in a practical way) the process of development (as diSessa calls it) of p-prims from a naive physics to the distributed encoding of an expert?

2 Systematicity

diSessa starts talking about modules. What does he mean? I think he is talking about a new concept, namely modes of thought. But for the most part he seems to be trying to contradict himself. He seems to admit that modes of thought exist in a naive physics, but what is a mode of thought? He views figural primitives as a mode of thought. He also may be suggesting that a “static predisposition” is also a mode of thought.

The strongest point I got from this intricately argued section is that he feels that learning does NOT involve the substitution of one ontology for another. The only decent argument he can put forward for this view is that naive models are so context dependent that they could never fit into a broad generalised ontology.

Anyone manage to glean anything useful from this section?