

Homework 4 - Motor Expertise

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February 15, 2013

1 Questions

1.1 Which two instructions in the "programming language" of the 2011 HW would be the most difficult for robots to follow?

The following instructions we thought were the toughest.

- *Hold pencil at $p = 2cm$, with M and T effectors*
As the robot doesn't have any sensors on his fingers, holding the pencil will require it to have applied the correct pressure. Moreover as the robot has just 2 points of contacts, it will have to balance the torque as well (the robot can do so as it has compressible fingers). This is a really tough task as one can see from the robot created by Kalakrishnan.
- *Rotate point of contact between I -effector and object, about axis defined by line passing through points of contact of M and T effectors (with object), by an angle such that P -axis lies at perpendicular distance of r from source point.*
In this step the robot needs to decrease the pressure it has applied so that it is able to rotate the pen but the pen doesn't slip off. This is also tough, to be able to get the right pressure it needs.

1.2 The robot following the learning paradigm as in Kalakrishnan is clearly gaining some expertise. Which aspects of the execution may be called implicit or automatic, and which aspects may be more explicit? What could be the "chunks" in this structure?

First of all we will need to tweak the definition of implicit knowledge. If we define implicit knowledge using the definition of tacit knowledge as something that is difficult to transfer to another person by means of writing it down or verbalising it, than as the robot is trained using a neural network as in Kalakrishnan's case then it will be aware of the mechanism that it uses to perform the task, thus everything in the execution will be explicit. Now let's suppose that the robot isn't allowed to look at whatever parameter it learns and is only aware of things it is hardcoded to do. Then in this case, it will be able to associate with the correct amount of pressure required in the execution as a chunk associated with the action of picking a pen. Then this will be implicit. In this definition the information such as locating the coordinates of the pen, its orientation, etc still hold on to be explicit as these were hardcoded in it.

1.3 Comment on whether human learning may also be following similar "reward" based processes? Consider the learning process for the fire-fighting expert who knows how to fight complex fires.

Human Learning is very much driven by feedback(both reward and punishment). These feedbacks can be internal as well as external. There are also very intrinsic motivations for the task we perform.

In the fire-fighting experiment, for the psychologist it is more of an internal feedback(satisfaction) seeing the fire go away as that is the most relevant feedback at that point of time. The video also talks about the fire-fighter already knowing the result of its action, showing his expertise. This appears to be more of a trained response, built by being told exactly the instructions to follow and then on practicing the instructions and making them more effective based on feedback. In this, someone starting with not much knowledge won't be able to do good just based on feedback. But as in the fire-fighters case, this feedback and repeated training has now encoded the process as a familiar pattern. So he intuitively makes the move.