

Some thoughts on "Cognitive tools"

One evident feature of our minds is that they are cultural organs. Humans have, for reasons that no doubt seemed evolutionarily good at the time, developed the means to store symbols outside our biological memory in such a way that we can access and retrieve their meaning at later times. It's been an immensely clever trick, but not without its costs. Another common analogy--common, at least, since Vygotsky showed its utility--is to think of the relationship between this externally stored symbolic material and our brains as a bit like the relationship between tools and our bodies.

This analogy invites us to reflect on our peculiar use of tools. Many animals use tools for particular purposes—to enable them to wrinkle grubs out from decaying wood or to break shells, etc.—but we seem to incorporate our tools in a quite distinctive manner. A new tool doesn't only enable us to perform some specific task; it changes our image of what we can do and even what we are. Once we invent a tool for some purpose we become alert to what else we can do with it. Long ago, our first tools were not invented with the idea of building metal machines that fly or huge skyscrapers or space vehicles, but the accumulation of tools and imagined possibilities for their use has led to these constructions. Our en-tooled body becomes transformed in our imaginations in its potency and possibilities.

If we think of our accumulated store of external symbols as a kind of tool-kit for the brain, we may use Vygotsky's analogy to explore how the brain becomes transformed by its incorporation of such tools. So literacy, for example, allowed us to leave records and retrieve them later, but, after millennia of development, it has transformed our lives immeasurably. Once the tool of writing was invented for recording quantities of stored grain and wine, humans began to explore what other uses it could be put to. This is a bloodless way of briefly and abstractly sketching something that has been complicit in all modern human lives, and in our joys, fears, plans, and so on. While we begin with simple utility, we stretch our symbolic tools in the direction of unsuspected possibilities. The stretch may be like that in Flaubert's most famous lines from *Madame Bovary* about the uses of language: it "is like a honky-tonk on which we beat out tunes for bears to dance to, yet all the while we long to move the stars to pity." As the Hebrew God muttered, observing the human creatures trying to build a tower to the heavens: "Behold how nothing will be restrained from them, from what they have imagined to do" (Genesis, II, 6). Tools plus imagination make new worlds.

So these references to an "external store of symbolic material" should be understood as the receptacle of our dreams as well as of our more utilitarian records. The building of this cultural storehouse is compared by Merlin Donald (1991, 2001) to a major evolutionary change in human intellectual functioning, and, he argues, we should see this cultural storehouse as having as much influence on the modern mind as the architecture of the brain itself. That is, our brain and culture together create the lineaments of the mind. Our brains include many capacities, such

as those for language and abstract thought, that are never realized in people who survive alone, apart from a culture; such brain capacities are not a part of the mind unless stimulated and developed within a culture.

If we see this external symbolic store-house as something whose internalization in individuals' brains constructs their minds and accept Vygotsky's idea that the tools, or "operating systems" and "programs," for our brains initially exist external to our bodies in our culture, then we may begin to conceive of education's tasks somewhat differently. Education becomes the process in which we maximize the tool-kit we individually take from the external storehouse of culture. Cultural tools thus become cognitive tools for each of us.

Apart from its unfamiliar terms, this might not seem obviously different from current ideas about education. Everybody has seen education as a process in which we select from what is available in our culture that which will best enhance the brain's capacities. One trouble with this abstract and general discussion, of course, is that it may be too easy to shift words a little to hide differences or exaggerate them. Let me take this chapter, then, to work out in more detail how education would look different from current norms and practices if we see it as a process of maximizing our cognitive tool-kit.

What are cognitive tools?

There is a short answer to this and a longer answer. The longer answer will be added in a new section later, in which I will describe and give examples of the main cognitive tools that we should attend to in educating people. The short answer is that cognitive tools are the things that enable our brains to do cultural work. Our brains, like those of any animal, are responsible for an array of physiological and social work. But we have also amassed that external symbolic material that constitutes our culture. As we learn features of our cultural inheritance, the brain is provided with the tools that enable it to realize various of its capacities. Alone, no one learns to speak, to read and write, or to think with theoretic abstractions. These potentials of human brains are actualized only by the brain learning, and learning to use, particular pieces from our cultural storehouse. Culture, as it were, programs the brain. It is simplistic to push the analogy of brain as computer and culture as operating systems and programs, but the analogy is helpful in so far as it locates a significant part of our minds in that culture material.

I recall my very Catholic family being scandalized, but also guiltily amused, by a doctor who, on the mention of the word 'soul' said that he had cut up men and women, black and white, and he'd never found a soul in any of them. We might offer a related comment to those who believe that studies of the brain will expose the working of the mind. There is no mind in the brain until the brain interacts with the external symbolic store of culture. People who think we have souls don't expect them to be visible to the anatomist, and people who reflect on the mind shouldn't expect neurophysiologists to provide new knowledge that will alter our understanding of what we need to do to minds in order to educate them. Well, one

can easily run into trouble pushing analogies too far. The point of this one being the near-invisibility of the mind in our current understanding of the brain, but the very plain visibility of the mind when viewed in terms of the culture our brains interact with.

One trouble with giving the short answer to the question of what cognitive tools are is that it is so general that it doesn't make clear what differences for educating people follow from thinking of education as maximizing cognitive tools. It might help, in moving on to the longer answer, to consider some other features of our brain/computer analogy. Perhaps, like me, you have recently upgraded the operating system of your computer. In these early years of personal computer, such updates are not always a simple matter. The companies that make these complex software systems tend to assure us—with balloons, flashing lights, and earnest managers of vast networks—that the upgrade will significantly increase our productivity, extend the speed, power, and reliability of the computer, and enable us to run even better programs than those we currently use—which the same company is generously willing to sell us. (I wrote this initially with a ballpoint pen; one of the less troublesome upgrades to the writing technology I favor).

But operating system upgrades are rarely as simple as we are assured they will be. Sometimes you discover that a neat little utility you have relied on in the past no longer runs under the new O.S. and there is no announcement about when there might be a new version. You find that some comfortable routines are disrupted, and you need to learn new work-arounds for unexpected problems. And odd things keep happening to our email. And those files you had saved in ... you no doubt recognize all this too painfully well. In general, though, you find that the new O.S. allows you to perform relatively easily functions that were previously cumbersome or impossible, and the programs that take advantage of the new O.S. enable you to work better and achieve some new tasks efficiently. That is, in general the new O.S. significantly improves what your computer hardware can do, but at a cost. Sometimes the cost is very small, sometimes quite big, and sometimes for some people in some circumstances the cost outweighs the benefits. We will find analogues to these costs and benefits in education.

If we think of our brains as like our computer hardware, we may think of cognitive tools as having two forms, equivalent to operating systems and to programs. Below I will describe five somewhat distinctive “operating systems” that our culture makes available to our brains. These five major cognitive tool-kits are available for downloading from our cultural storehouse. But their basic codes are complexly inter-related, so that for the optimum functioning of your mind they need to be downloaded in the sequence in which they were compiled in the first place. (O.S. 5, as it were, can't be successfully installed if you are running O.S. 2; you have to upgrade to O.S. 3 then O.S. 4 before you can get all the benefits of O.S. 5.)

Each O.S. enables you to run a large set of programs—smaller scale cognitive tools. Many of these are reverse compatible, but within variable limits; many of those

compatible with the previous O.S. will still run under the new system, some will not, and some will run but behave eccentrically. The task of education, given this analogy, is to ensure the fullest downloading from our culture of the five main “O.S.” cognitive tools in proper sequence, and also downloading for each the maximum range of “program” cognitive tools.

Again, this is a useful but limited analogy. The use will, I hope, become clear as I describe education in terms of maximizing our cognitive tool-kits. The limit—or one limit—is that unlike computer operating systems the smaller-scale “program-like” cognitive tools are in part constituents of the “O.S.” cognitive tools. But keep going, and I think you’ll see what I mean.

The mind’s operating systems and programs The main cultural work that cognitive tools enable our brains to perform is understanding. Seeing education as a process of maximizing our cognitive tool-kit, then, is to see it as a process of enlarging our understanding as far as possible given the tools our culture has developed. I will, later, add a section describing the main “operating systems” cognitive tools as kinds of understanding, which I call somatic, mythic, romantic, philosophic, and ironic. (I have made some earlier attempts to describe these, summed up in Egan, 1997 [The Educated Mind].)

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