Autopoiesis, language, literacy, and the brain

Introduction

When we attempt to speak about the relationship between language, literacy, and the brain, we find ourselves ill-equipped to deal with these conceptually and qualitatively different phenomena. Immediately we must straddle different academic traditions that treat each of these as separate "things". Broadly speaking, the study of language firstly belongs to the domain of biology, then to anthropology, sociology, and linguistics. At its most functional, a study of literacy education is a study of a particular technology, its diffusion techniques, and the abilities and motivations of people to adopt, or adapt themselves to, this technology. The brain is most commonly studied in the field of neurology, which is also a sub-discipline of biology, biochemistry, and medicine.

By highlighting disciplinary divisions between the three phenomena under investigation, I wish to show the paradoxical and perhaps impenetrable relationship between language and thought – most often attributed to the proper functioning of the brain – and the primarily technological relationship between language and literacy. The argument I briefly present here is that the way we have come to understand and describe literacies of various sorts, especially the ability to read and write, gives us a distorted view of language and the brain – and, perhaps, even of ourselves as learning, languaging creatures.

Some problems with cognitivism

Language, literacy, and the brain most certainly have a lot to do with each other. Pinker's (1994) account of cognitive linguistics is an exemplar of the cognitivist approach to reconciling the relationships between these phenomena. The prevailing attitude of cognitive linguistics, which imagines the brain to be the generative "source" of language and meaning, ignores some fundamental aspects of the human organism, its cognitive processes, and the role that social embeddedness plays in constituting the environment in which the social processes of language and

cognition take place. Pinker (1994, 1997), describes the brain as a computational mechanism. Its functionality is assessed in terms of its ability to calculate and represent the world; to encode and decode reality; and it its ability to effectively give "instructions" to the rest of the body.

The intractable difficulties of accepting the cognitivists' argument can be explained quite quickly. Firstly, if the brain were a machine that decoded and encoded the world for its "user", then language that describes concepts could not properly exist. This is because abstract concepts (for instance, "equality") cannot be separated from the language used to describe them, whereas pork chops, for instance, can. Next, we must impute some tricky, basically mechanical connections: if thought and language are separate "things", and the brain is the mechanism that somehow connects them, then we must say where language, thought, and the brain "end" in terms of their functionality (not to mention the reductionist project of deducing the functions of ever-smaller parts of the brain). Then we must infer the nature of these mechanisms. Finally, if we *do* deduce some mechanisms that connect these three theoretically discrete elements, then we must account for self-reflexivity: the "mind". This last conceptual barrier is best explained in the form of a *gedanken* experiment devised by Restak (1995: 88-9).

Imagine that you are neuroradiologist who has the ability and technology to perform a magnetic resonance imaging (MRI) test on your own brain. You could move your body and simultaneously see where corresponding brain activity occurred. Then you could talk, or merely decide to think about something, again watching the MRI for activity. Immediately, self-reflexivity becomes a problem. This is because the issue arises as to the relationship between your intention to perform movements, words, and thoughts for the purpose of seeing what effects occur within your own brain according to the MRI output. In other words, your intention to move, speak, or think must either be taken into account as part of the test results, or you must assume that your '*mind* is directing the operation of your brain' (Restak 1995: 89). Descartes' ghost suddenly looms large in the MRI machine's output. Suddenly the body, including the brain, is a mere appendage which the mind directs.

The ‘teeny weeny people’ solution

Never fearful of tackling the most complex questions on the simplest terms, Pinker (1997) elaborates a technologically updated metaphor of the ancient homunculus solution to conscious experience. The homunculus theory imagines a Russian doll arrangement of sentient little people, each inside the head of the one larger, each of which directs “traffic” inside the brain of the larger homunculus. Pinker, apparently armed with the knowledge that flatter management systems are the order of the day, describes the latest version of the homunculus solution. He calls it, charmingly, ‘the production system’:

> A production system contains a memory and a set of reflexes, sometimes called “demons” because they are simple, self-contained entities that sit around waiting to spring into action. The memory is like a bulletin board on which notices are posted. Each demon is a knee-jerk reflex that waits for a particular notice on the board and responds by posting a notice of its own. The demons collectively constitute a program. As they are triggered by notices on the memory board and post notices of their own, in turn triggering other demons, and so on, the information in the memory changes and eventually contains the correct output for a given input. Some demons are connected to sense organs and are triggered by information in the world rather than information in memory (1997: 69).

Descartes’ God is substituted by Pinker’s system of demons. It is as if, for Pinker, the mind were situated somewhere other than “in the world”. And questions about the ‘demons’, with their ‘notice board’ system of mutually triggering, ever-patient, sentient sticky notes, bear little conceptual scrutiny without resorting to numerous metaphysical assumptions. The homunculus theory has never really gone out of fashion in mainstream thought, especially not since Descartes, Newton, and the Enlightenment got together to provide a more “rational” approach to understanding the universe, our machines, and ourselves as egg-in-cup reflections of one another.

But one should not be too harsh on Pinker and the cognitivist school. Such technophilically derived explanations are to be expected. Since recorded history, and even more noticeably since the Enlightenment, the way in which we have described ourselves as thinking, acting beings most often bears an uncanny resemblance to our

most advanced technologies, which includes our institutionalised conceptions of God (cf. Innis 1951). This is not surprising if we consider the role of technologies, especially communication technologies, which are humanity's primary means of socio-environmental control (Innis 1951).

Literacy as a technology

Increasing numbers of our technologies, which can be defined as abilities to control elements of our physical and social environments, are described as literacies. Without going into a full literature review on the subject, one can easily find references to "financial literacy", "cultural literacy", "political literacy", and, most importantly these days, "technological literacy" (eg Bigum & Green 1993).

If we look at the history of our technologies, and particularly our communication technologies, we see a number of interesting patterns corresponding to the way we describe ourselves in terms of *what* we are, or at least of how we operate (cf. Innis 1950). Just as Newton's clockwork universe ratified Descartes' view of the body as a machine inhabited by an ethereal mind, the historical trajectory of communication technologies, from orality and print to the widespread use of the telegraph, radio, television, and finally the personal computer (PC), has ratified views of the world as something that can be encoded and stored in memory, collective or otherwise. But this is to confuse the map with the territory. Language, at least from an autopoietic perspective, is neither a code (although it can be encoded) nor a technology (although it can be technologised). Language is, rather, both a human behaviour and an environment.

Autopoiesis: a brief introduction to the biology of cognition

The significance of an autopoietic perspective for language and literacy lies in Maturana and Varela's (1980, 1987) assertion that the presence of cognitive processes within a system is both necessary and sufficient to classify the system as living. In other words, the basic criteria of a living system is that it has the ability to distinguish between itself and its environment (Maturana 1978: 36; Maturana & Varela 1980: 96). Such a system is also necessarily *autopoietic*, which means, literally, self-making. To

discover how knowledge is produced in autopoietic systems, the unit of analysis becomes *the whole organism*, and we must 'discover "regions" that interweave in complex manners, and, in the case of humans, that extend beyond the strict confines of the body into the socio-linguistic register' (Varela 1992: 14). Maturana's perspective on the role of language in human society is even more forthright than Varela's: 'language defines humanity' (Maturana 1988).

Language differs from linguistic behaviour, such as that displayed by birds, apes, or dolphins. Linguistic behaviours are behaviours that coordinate other communicative and social behaviours. Language is possible only because humans can interact with their own descriptions of the world, which necessarily include those of their own internal states. Consequently, language and self-consciousness are concomitant with each other:

> [A] living system capable of being an observer can interact with those [observations] of its own descriptive states which are linguistic descriptions of itself. By doing so it generates the domain of self-linguistic descriptions within which it [the system] is an observer of *itself* as an observer, a process which can be necessarily repeated in an endless manner. We call this the domain of self-observation and we consider that self-conscious behaviour is self-observing behaviour, that is, behaviour in the domain of self-observation. The observer … necessarily always remains in a *descriptive domain*, that is, in a … cognitive domain (Maturana & Varela 1980: 121).

As humans, observers, and describers, our knowledge is a socially and technologically constrained phenomenal domain. To explain: we humans are born into an environment of language, and therefore knowledge –preconceived ways of ordering and relating the world. We are told, in language, how to encode language in socially conventional ways, thereby becoming literate. Literacy, from this perspective, is a socially acceptable level of fluency in a technology which is the means by which we produce, hoard, consume, and distribute meanings (distinctions, descriptions, cognitions, and re-cognitions) made in an environment of language. Of course, I have over-simplified literacy here to emphasise the difference between literacy, which is a technology, and language, which is a biological phenomenon that largely constitutes the socio-cognitive environments into which we are born.

Language as an environment

My purpose in describing language as an environment is to emphasise the social aspects, origins, and functions of language. Imagine, for a moment, that language systems are environments that are constituted as concretely as, for instance, a city. Imagine a person, newly arrived in this city, learning to navigate their way through their new environment. Without stretching the metaphor too far, we can imagine this individual eventually finding their way around the city; developing a taste for particular restaurants, shops, and shortcuts; finding suitable lodgings and an occupation; and, more often than not, settling into particular routines and locales that suit her or him. In turn, their participation in this environment changes the environment itself.

Language *is* an environment into which we are born. Its Participants, Processes, and Circumstances create the framework for the socio-cognitive environments in which we move, mean, and understand (Graham, in press). The socially produced and reproduced environment of language pre-exists each of us, is embodied by us, and it allows us to exist in society as we do. Trying to separate language from thought, as Vygotsky (1986) recognised, leads to certain intractable difficulties which eventually boil down to a chicken and egg conundrum: one cannot conceivably exist without the other, at least not in any socially meaningful sense (it may be conceivable to some that a fish experiences thought, but we cannot know what it thinks). But, because we can so easily (at least for some) separate our language, and therefore our thoughts, from ourselves by using the technology of literacy, we are easily seduced into the idea that the creations (distinctions) we make in language actually exist as something objectively distinct from our socially embedded selves. Consequently,

> we live existing in our language as if language were a symbolic system for referring to entities of different kinds that exist independently from what we do, and we treat even ourselves as if we existed outside language as independent entities that use language (Maturana 1995).

The cognitivist confusion which sees the brain's operation reflected in the dreamland of gleaming digital technologies merely extends the confused perception that arises from thinking of language firstly as a code, merely because it can be technologically encoded. As the saying goes: "give a kid a hammer and the whole world becomes a nail".

What neurology has to say about the brain: "It's broken …"

Neurology, like cognitive linguistics, often describes the brain as 'the preeminent information processor' (Restak 1995: 124). When speaking about the brain, neurologists tend to express themselves in terms of abnormalities (1995: 74). From the point of our investigation, this immediately raises two paradoxes. First, the brain appears as an object spoken about in language, which the brain, at least from the cognitivist and neurological perspective, supposedly "controls". Secondly, from the neurologists' perspective, the brain has two states: normal or abnormal.

Part of the reason for this is that specific brains usually only become of interest to neurology when they are damaged, or show signs of damage. To put it in the words of an eminent neurologist:

> Most of what we know about the brain has come from the meticulous examination of the effects of injury or illness. Typically a neurologist correlates what is observed about the affected patient during his [*sic*] illness with changes in the brain discovered during an autopsy examination (Restak 1995: 74).

Neurology, then, believes that by understanding how a damaged or malfunctioning brain hinders the "normal" operation of other biological functions we can understand which bit of the brain controls which bit of the body. Of course, this presumes that the chicken and egg question is answered in the affirmative for Cartesianism: that is, that the brain dictates how the body operates and that the body is merely an appendage of the brain. With this approach to understanding the brain, neurology has also advanced its knowledge by such rigorous means as mutilating monkeys and other animals to see how brains change with physical damage:

> Just as the borders of a country change to reflect natural and human-produced changes, the brain alters itself on the basis of experience. In the monkey experiment the "brain map" was altered by the cruel act of cutting off one of the monkey's fingers. Within the next several weeks the neurons formerly controlling that finger were incorporated into the brain areas representing one or more of the remaining fingers (Restak 1995: 93).

The paradoxes inherent in seeing the brain as a Cartesian, ostensibly isolated element which processes information and controls the body again become apparent. Even while seeing direct evidence of the brain's reliance on the conditions in which the body finds itself, the neurologist insists that the neurons formerly *controlled* the monkey's former finger. It seems doubtless that the brain is intrinsic to the "normal" functioning of the whole body (whatever "normal" might mean in this context), but to assume that the relationship is one-way dictatorial on the part of the brain flies in the face of logic, and the evidence presented by the ghastly experiments that Restak describes (the monkey's neuronal activity is checked by removing part of its skull and connecting electrodes to its exposed brain).

Further difficulties become apparent when we draw an analogy based on the assumptions of mechanistic neurology. Assume, for a moment, that cars were a naturally occurring phenomenon, by which I mean *not* manufactured by people. Your job is to deduce how cars operate based on the symptoms of various types of mechanical failure. Your focus is engines, which are assumed to make cars go. You assume that all engines are "normal" and fairly homogenous until they break down. You have no comprehensive or definitive knowledge of how the engine is connected to the rest of the car, nor do you take into account that engines all develop differently and operate in different environmental conditions. If you try to remove the engine from the car, it stops going. Thus, the only engines you can examine are from cars that have ceased working altogether. Therefore, you can't examine the structure and function of the engine at the same time.

By taking this approach to mechanics (which I think is how my mechanic does it), you will, at best, develop a taxonomy of engine disorders corresponding with specific symptoms, the most common of which will appear to be self-evident,

empirically derived truths. But none of these disorders will necessarily have anything to do with the structure or function of cars *or engines*. Using the approach I outline above, one could only describe cars in terms of the various malfunctions they suffer. Nor would such a taxonomy necessarily be of use in fixing the car, regardless of its condition. The taxonomy would only necessarily be coherent in terms of itself and the attributions of an ultimately abductive observation of disorders.

I'll leave behind neurological disorders now - many of which can cause learning "disorders" - and move on to the implications for literacy of what I have said so far.

Technologising the environment of language

Caveat emptor: I must confess, although I teach communication in a university, I do not consider myself to be an expert at teaching literacy. Therefore, anything I say about the subject should be treated with the suspicion that any unindoctrinated layperson ought to evoke among experts. Lack of expertise notwithstanding, my familiarity with the polemic between whole-language and phonics, formalism and functionalism, gives me the perspective of a reasonably well-informed and very interested onlooker. Such arguments, in some instances, can be dismissed as ideological trench warfare wrought by a good deal of intellectual investment on the part of well-intentioned experts. Based on the perspective I have outlined above, I argue that multiple understandings of language, literacy, and the brain are quite necessary for successful education. Still, even with an understanding of context (environment) and phonemic literacy (a basic sub-technology of literacy), learners of literacy are left with a conceptual gap which can only be filled by a functional understanding of grammar.

To explain this assertion, I will (forgive me) use another analogy. Literacy, as I have said, is a technology. Although, like all technologies, it contains language, it is not language. Let us again take the technology of cars as an analogy. If we wanted to teach people how to make their own car, we would need to teach them a number of things. First, they would need to be familiar with the qualities that cars can possess, and which contexts these qualities are suited to: do they want to build something like

the latest German sports car, a vintage banger, a four-wheel drive, or an armoured personnel vehicle? By showing our student a range of cars with various qualities, we could give them some idea about the type of car they want to build. Next, our student needs to become familiar with the bits that go together to make a car: nuts and bolts, carburettors and camshafts, windshields and widgets. All that being done, we ought to be able to leave our student because they have everything they need: a knowledge of what makes a car "good", a knowledge of what cars do, and knowledge of the bits that go together to make them up.

Of course, we *can't* leave our student there, not if we want to teach the capability to build, or even fix cars. Even though our student knows what sort of car she wants to build, and she knows which bits do what, she doesn't know is *how it all goes together*: she doesn't know the grammar of car construction. Without that knowledge, she is unlikely to build a complete car. We would not expect someone to become a competent mechanic without a comprehensive understanding of the relationships between the parts of a car – that is, how cars function as systems. It is even less likely that our student would become competent in fixing or building cars with specific qualities for specific purposes without a knowledge of the mechanics of excellence; in literary terms, a knowledge of genre and functional grammar. No homogenous or doctrinaire formalisms would do in either case, neither in car mechanics nor literacy.

Conclusion

My argument here is underpinned by more-than-mild alarm at the levels of literacy amongst young people. Many have never (and possibly will have never) learned the technology of writing down their thoughts in a coherent or socially acceptable way. Martin's (1998) *Linguistics and the Consumer* is an excellent indictment of the effects, real and potential, of the theory wars among literacy teachers, the public, and the state. I can add no more to what Martin has said on the matter. What I hope I have achieved here is to distinguish language (which is a socio-biological phenomenon) from literacy (which is a communication technology), and brains from computers. The brain is not merely an information processor, although it can do calculations, and invent notions such as calculation, information, and

processes. Nor is it even necessarily a single organ. It is certainly neither the sole source of cognition nor the controlling, *ex machina* engine of the body.

If we wish to teach literacies, we must teach them to people, not brains. Thus, we must teach *all* relevant aspects of the technology. This is especially so since the preeminence of computers in the classroom. The hopeful enthusiasm for computers amongst some educators - and more particularly, the computer industry - may well be warranted, but their potential benefits will not and cannot be realised unless our children learn the communication technology upon which computers are founded: namely, print literacy. There are other social and political implication for seeing ourselves as mere reflections of our finest technologies, and these must always be considered. Because machines are more and less advanced, and therefore more and less valuable, a latent fascism lies in such understandings of ourselves, but these matters must be discussed elsewhere.

At the risk of seeming theoretically profligate, I can only conclude that multiple approaches to literacy education are required, theories of the brain notwithstanding. The appropriateness of any particular approach will depend on the individuals being taught, and what they wish, or need, to achieve by their education. Doubtless, my conception of language will raise the ire of those committed to seeing language as a code, or as a technology in itself. So be it. In the end, one must ask: “a code for what?” and “a technology for whom?”.

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