Pylyshyn and the Chomksy Hierarchy

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1 Zenon Pylyshyn

Zenon Pylyshyn was one of the early proponents of a view known to day as functionalism. The crux of his view is that the mind is essentially computational where the brain is analogous to hardware and the mind is analogous to software. With this view point comes the possibility of multiple realizability for human minds. The thinking was that if the mind is like software running on the hardware of the brain, then just like a piece of computer software can run on many different computer hardware, the mind should be able to run on different hardware from the brain, or at least on other brains.

Pylyshyn broke down the mind into levels that where cognitively penetrable and cognitively impenetrable. The penetrable level was the algorithmic level of the software, and a function was defined as being penetrable if the function could be changed by altering one's beliefs and/or goals. The impenetrable levels were thought of as the functional architecture and included base level input sensations and autonomic functions that could not be changed by altering beliefs or goals. Pylyshyn also suggested that particular software running on the algorithmic level in humans can be checked to see if it is weakly or strongly equivalent to another persons software algorithms via reaction times. If the reaction times for the same task where the same, then it meant that the two algorithms were likely strongly equivalent. Likewise, if the reaction times were not similar then it stood to reason that the algorithms were only weakly equivalent.

One of the problems with viewing the mind as a computer is the problem of semantics. The issue is that computers work with syntactic rules applied to meaningless symbols. And if computers only work with syntax, how can semantics be developed from just syntax. Pylyshyn argued that the symbols operated by syntax have meaning when they behave in the way that symbols with a specific meaning should behave.

My view of Pylyshyns work is that it falls a bit into the same trap of trying to think of the brain as the latest most complicated technology around. To his credit, he did say that the brain as computer might not use the same architecture as the Von Neumann architecture used in modern day computers, suggesting that unless we change how a computer works, a true simulation, or multiply realized brain won't work. I am also leery of his solution to the problem of semantics. It appears to be a non-answer that doesn't really explain anything. To be fair, I am not sure that there is a really clear understanding of what is meant by 'meaning', but my own thoughts are that meaning is probably best thought of as relational knowledge, and in humans there is a definite embodied aspect to anything that has meaning.

2 Chomskey's Hierarchy

Chomksey's Hierarchy was a hierarchy of grammar structures. His basic idea was that language structures can be thought of as simple grammar structures, jettisoning the notion of semantics for this purpose. His structures each consisted of a formal language that was comprised of four parts: a finite vocabulary of symbols called terminals, a second finite vocabulary of extra symbols called non-terminals, a special non-terminal called the start symbol, and a finite set of rules. He then had four hierarchies of languages: computably enumerable languages, context-sensitive languages, context free languages, and regular languages. His hierarchy was especially useful in computer science applications, but interestingly enough does not contain any natural language, such as English. Since his initial development of the hierarchy there have been several additions and modifications over the years as needed.