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Rethinking the Mind-space: A Non-commutative Approach to Psychology

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A hundred years ago the idea to apply Newtonian laws of motion to psychic energy gave rise to the psychodynamic way of thinking. Although, in general, the prolonged inhabitation of the past century's positivist scientism in today's thought is of little merit, this synthesis of two disciplines nonetheless remains one of science's great success stories

The question that I wish to raise in this paper concerns the use of mind-space simile in psychology. While the spatial metaphor is embedded in psychodynamic thinking (and most other models), the assumption about space that it makes is quite inaccurate in light of our present-day knowledge. It would seem to me that the validation of the mind-space simile against our updated concept of spatiality in itself is worth pursuing, but the real benefit of such investigation lies in the possibility of feeding a new set of ideas into an old theory. There is an increasing number of researches that utilize quantum theory and non-commutativity in psychological studies (for an overview see Atemnspacher & Flik, 2014). Non-commutative psychology is not a contemporary invention. Its history can be traced at least as far as Jung and Pauli:

'A particularly interesting historical step was the proposal by Pauli and C.G. Jung in the mid 20th century to apply the concept of complementarity to the relation between the mental and the physical in their framework of dual-aspect monism (…) they also conjectured that the uncontrollable backreaction that an observation leaves on a measured physical state has an analog in the observation of mental states (…) this plausible idea directly entails that observations of mental states should, in general, be non-commutative'. (Atemnspacher & Flik, 2014)

Jung's and Pauli's proposal boils down to two statements: a) the mental and physical are part of the same system and b) this system is subject to uncontrollable change when measured;

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a case that nowadays would be best described as a non-commutative transition.

Graininess and Continuum

Take a piece of paper and a pencil. Holding the pencil lightly draw a straight line. Call the beginning of the line point A and the end point B. Now, would you say that your line is continuous? If you look closely you will discover that it is not - your line consists of dense points. If the texture of your paper is rough the points will be jagged and you will be able to see gaps between them. If your paper is smooth the mark may appear uninterrupted but, rest assured, if you ventured to examine it under the microscope it would prove to be serrated. What would it take to draw a perfectly continuous line? You would need to obtain perfectly smooth paper and drawing tool, both of which do not exist smooth structures do not exist at all. Matter has an innate property of graininess. It is built up from small blocks - atoms.

Smooth structures are easy to envisage, therefore they are widely used as an approximation; a sort of mental shortcut. Nonetheless in the study of non-commutative spaces, we need to consider the aspect of graininess. It boils down to the question of whether thought process can be described as constant at its structure level, or whether we can discern ‘thought atoms.

Graininess in mathematics

Let us rename points A and B and call them 0 and 1. What is the distance between the extremes of the line? Surely it is one unit. But by indicating a unit we create a mathematical version of a smooth structure. Or perhaps not? Perhaps it is possible to have a perfectly continuous mathematical line since limitations of the physical world do not necessarily project onto mathematical constructs?

’Between 0 and 1 are numbers such as ½, ¼, 1/5, etc. Between 1 and 2 are 1 ½, 1 ¼, and so on. Other numbers such as 358/719 and the like - all fractions - are found easily on number line. But the real *length*, the “meat” of the real line does not come from squeezing numbers onto it. Even with infinite condensation of *all* the fractions and integers- all the *rational* numbers- onto the segment of the number line, all we would have is sieve riddled with infinitely many holes, but not a solid line. The real fabric of line requires the *irrational numbers*. Without irrational numbers, we would have an infinite collection of dots, very dense, but not a solid, not a line’. (Aczel, 2000, p. 84 italics original)

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It seems that we would be able to draw a continuous mathematical line if we included all the infinite fractions and infinite sets of irrational numbers between each of these fractions. Few people in history have dared to venture into the realm of higher levels of infinity and most paid for their courage with their sanity (Aczel, 2000). But the situation is even more complex than that. We know about the existence of irrational numbers such as π since antiquity and, thanks to Cantor's theorem, we know that there are different kinds of infinities; the transfinite numbers. However what proof do we have that the "property of connectedness" (Aczel 2000, p. 84) holds in these exotic sets? The question touches the very existence of continuum:

'What Cantor didn't k know- *couldn't possibly know*- was that he was working on an impossible problem. We know that the continuum hypothesis *has no solution* within our system of mathematics. (…) The continuum hypothesis is undecidable within the realm of our mathematics'. (Aczel, 2000, p. 155 italics original)

Transformations

Imagine artificial intelligence equipped with mathematical mind-space encoded in binary matrixes. For the moment. let us define intelligence as the ability to gain new insight from existing data. It should be obvious that the atom of intelligence is not the matrix itself - not the encoded memory unit. Neither is it the ability to expand or retrieve memory units. In this case, what we would call intelligence is the ability to *transform* an informational unit from one state of knowledge to another. Learning of an intelligent entity doesn't come by adding information alone, rather learning is moving from one instance of knowing to another.

Non-commutativity occurs by *a transition* from one 'locum' to another. This transition is not unlike neurotransmission of impulses in the brain (thus we could say with some confidence that neural processes are non-commutative). From the above the following question arises: should we think of thought-atom as a continuous transition, or would it be better described as a series of steps leading from one knowledge state to the next? Neither proposal is entirely agreeable. Our question echoes Zeno's paradox with tortoise and Achilles:

'Because he is much slower, the tortoise is given a head start. Zeno reasoned that by the time Achilles reaches the point at which the tortoise began the race, the tortoise will have advanced some distance. Then by the time Achilles travels that new distance to the tortoise, the tortoise will have advanced further yet. And the argument continues in this way ad infinitum. Therefore, concluded Zeno, the fast Achilles can never beat the slow tortoise. Zeno inferred from his paradox that motion is impossible under the assumption that space and time can be subdivided infinitely many times'. (Aczel, 2000, p. 12)

Of course, in the real world movement does exist. We conquer distances not by continuous

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movement but by taking steps, by skipping sections of the road. Taking a step is literally a *transition* from one locum to another. Now let us replace physical movement with mental movement.

It would appear that graininess is a preferred description only at a certain scale of reality. Not at a macro scale, since we perceive ourselves as continuous and living in a world of whole entities (as opposed to particle-clouds) occupying continuous space-time. And not at a fundamentally small scale, because, as we have learned from Zeno's paradox, it is unrealizable to divide motion indefinitely. This notion is highly unsatisfactory since there is no logical constraint that would impose different descriptions of space at different scales, thus, it must be concluded, that there is a flaw in our perception. We have not yet introduced consciousness into our hypothesis (consciousness is not synonymous with intelligence), nevertheless, let us consider the following quote from Miller (1962, p. 54):

'Everyone would probably agree that changes in consciousness are continuous; there is no succession of discrete photographs, but a stream that flows from one state of consciousness to the next.'

We are at the crossroads. Either we assume that thoughts are continuous, i.e., that they are smooth structures, or we follow the notion of graininess, which will leave us with a "succession of discrete photographs." My answer to this puzzle would be that thought-atom is comparable to electromagnetic waves (for instance light). By adopting this view, we avoid the pitfall of ascribing either graininess or smoothness as a necessary description of consciousness flow.

Going back to our example of artificial intelligence we can discern something other than transitions, namely the data bank of matrixes. When no operations are made on them, these codes appear to be grainy. The question we should be asking now is whether information has an intrinsic property of graininess when it is not in 'moving'. This is a significant problem because, to put it simply, thought *is* information. One could argue that considering the implications of quantum mechanics and relativity, the entire universe is reducible to information.

References

Aczel, A. (2000). *The Mystery of Aleph: Mathematics, the Kabbalah, and the Search for Infinity*, New York, Washington Square Press

Atemnspacher, H and Flik, T. (2014). 'Non-Commutative Operations In Consciousness Studies', *Journal of Consciousness Studies* 21, *Researchgate* [Online]. Available at: https://www.researchgate.net/publication/263763914_Non-Commutative_Operations_in_Consciousness_Studies (Accessed on 01/01/16)

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Miller, G. (1962). *Psychology: The Science of Mental Life*, Harmondsworth, UK, Penguin Books Ltd

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