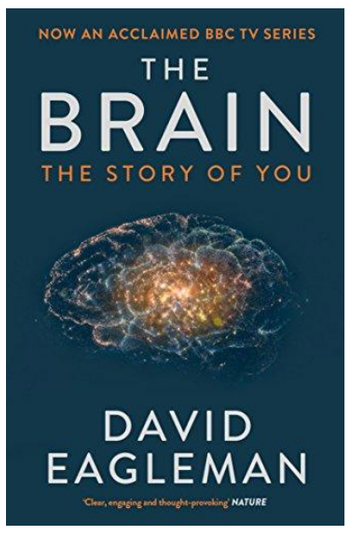

kindle

The Brain: The Story of You

by Eagleman, David

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> Born Unfinished At birth we humans are helpless. We spend about a year unable to walk, about two more before we can articulate full thoughts, and many more years unable to fend for ourselves. We are totally dependent on those around us for our survival. Now compare this to many other mammals. Dolphins, for instance, are born swimming; giraffes learn to stand within hours; a baby zebra can run within forty-five minutes of birth. Across the animal kingdom, our cousins are strikingly independent soon after they're born. On the face of it, that seems like a great advantage for other species – but in fact it signifies a limitation. Baby animals develop quickly because their brains are wiring up according to a largely preprogrammed routine. But that preparedness trades off with flexibility. Imagine if some hapless rhinoceros found itself on the Arctic tundra, or on top of a mountain in the Himalayas, or in the middle of urban Tokyo. It would have no capacity to adapt (which is why we don't find rhinos in those areas). This strategy of arriving with a pre-arranged brain works inside a particular niche in the ecosystem – but put an animal outside of that niche, and its chances of thriving are low. In contrast, humans are able to thrive in many different environments, from the frozen tundra to the high mountains to bustling urban centers. This is possible because the human brain is born remarkably unfinished. Instead of arriving with everything wired up – let's call it "hardwired" – a human brain allows itself to be shaped by the details of life experience. This leads to long periods of helplessness as the young brain slowly molds to its environment. It's "livewired".

Amazing...

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> What's the secret behind the flexibility of young brains? It's not about growing new cells – in fact, the number of brain cells is the same in children and adults. Instead, the secret lies in how those cells are connected. At birth, a baby's neurons are disparate and unconnected, and in the first two years of life they begin connecting up extremely rapidly as they take in sensory information. As many as two million new connections, or synapses, are formed every second in an infant's brain. By age two, a child has over one hundred trillion synapses, double the number an adult has. Livewiring Many animals are born genetically preprogrammed, or "hardwired" for certain instincts and behaviors. Genes guide the construction of their bodies and brains in specific ways that define what they will be and how they'll behave. A fly's reflex to escape in the presence of a passing shadow; a robin's preprogrammed instinct to fly south in the winter; a bear's desire to hibernate; a dog's drive to protect its master: these are all examples of instincts and behaviors that are hardwired. Hardwiring allows these creatures to move as their parents do from birth, and in some cases to eat for themselves and survive independently. In humans the situation is somewhat different. The human brain comes into the world with some amount of genetic hardwiring (for example, for breathing, crying, suckling, caring about faces, and having the ability to learn the details of their native language). But compared to the rest of the animal kingdom, human brains are

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> If developing brains are not given the proper, "expected" environment – one in which a child is nurtured and looked after – the brain will struggle to develop normally.

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> The Teen Years Only a couple of decades ago it was thought that brain development was mostly complete by the end of childhood. But we now know that the process of building a human brain takes up to twenty-five years. The teen years are a period of such important neural reorganization and change that it dramatically affects who we seem to be. Hormones coursing around our bodies cause obvious physical changes as we take on the appearance of adults – but out of sight our brains are undergoing equally monumental changes. These changes profoundly color how we behave and react to the world around us. One of these changes has to do with an emerging sense of self – and with it, self-consciousness. To get a sense of the teen brain at work, we ran a simple experiment. With the help of my graduate student Ricky Savjani, we asked volunteers to

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> Why the difference between the adults and teens? The answer involves an area of the brain called the medial prefrontal cortex (mPFC). This region becomes active when you think about your self – and especially the emotional significance of a situation to your self.

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> There are a hundred billion neurons in the human brain, and each neuron sends tens or hundreds of electrical pulses

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> Neurons communicate with one another via chemical signals called neurotransmitters.

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> Their membranes carry electrical signals rapidly along their length. Although

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> Biology has discovered many ways to convert

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> One of neuroscience's unsolved puzzles is known as the "binding problem": how is the brain able to produce a single, unified picture of the world, given that vision is processed in one region, hearing in another, touch in another, and so on? While the problem is still unsolved, the common currency among neurons – as well as their massive interconnectivity – promises to be at the heart of the solution.

Yes magical

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> What does your brain need to function normally? Beyond the nutrients from the food you eat, beyond the oxygen you breathe, beyond the water you drink, there's something else, something equally as important: it needs other people. Normal brain function depends on the social web around us. Our neurons require other people's neurons to thrive and survive.

Important point
