4. The Neurobiology of Δ (Change)

The capital Greek letter Delta **Δ** (which has the convenient form of an equilateral triangle) is commonly used in subjects of science, mathematics, and the medicine as an abbreviation for "change". This is because delta is the initial letter of the Greek word διαφορά or *diaphorá*, which means "difference". It is a meaningful symbol to me because my passion is **Δ(change)**. The way I see it, either we can **Δ** or we can't – right? Since I believe with all of my heart that each and every one of us truly can **Δ**, then I am going to find the very best way to make that **Δ happen. Δ^2 is my own invention and literally means 'change squared'. What this means to me is that using cognitive strategies increases the power to change exponentially.**

When I was just finishing up my master's program at Indiana University in Fort Wayne in 2002 I experienced a 'game changing' event in my life, and like so many others, it was rather unexpected. I was utterly fascinated with the Cognitive-Behavioral (CBT) approach to therapy and was busy learning everything I could about it. One of my assignments in the program was to write a paper on 'which theory I had learned the fit the closest with my own personal paradigm'. I, of course, picked CBT, it was by far the winner in that category.

I researched the heck out of CBT and wrote an awesome paper, probably one of my best. The way my brain works, when I get in research mode I read anything I can possibly get my hands on regarding the topic and so I definitely had CBT on the brain. As well as I was becoming acquainted with the approach I was also pondering how the approach had impacted my own life. What I hadn't yet done too much research into was the neurobiological aspect of how change occurs in the brain.

I knew much of what there was to know about how to practically apply the theory, but I hadn't considered researching any further into what was actually happening at the cellular level in my brain. Of course I knew about neurons and synapses and how anti-depressants worked, but beyond that, the neurobiology had not been a particular focus of my attention. One day I was reading an article in Reader's Digest about the brain. In the article a book by Joseph LeDoux entitled "Synaptic Self" was referenced. The article spoke briefly about something called 'neuroplasticity', a term I had never heard of before. The article itself was not particularly moving, and had I not been in that place mentally, would have never caught my attention. But needless to say, it did.

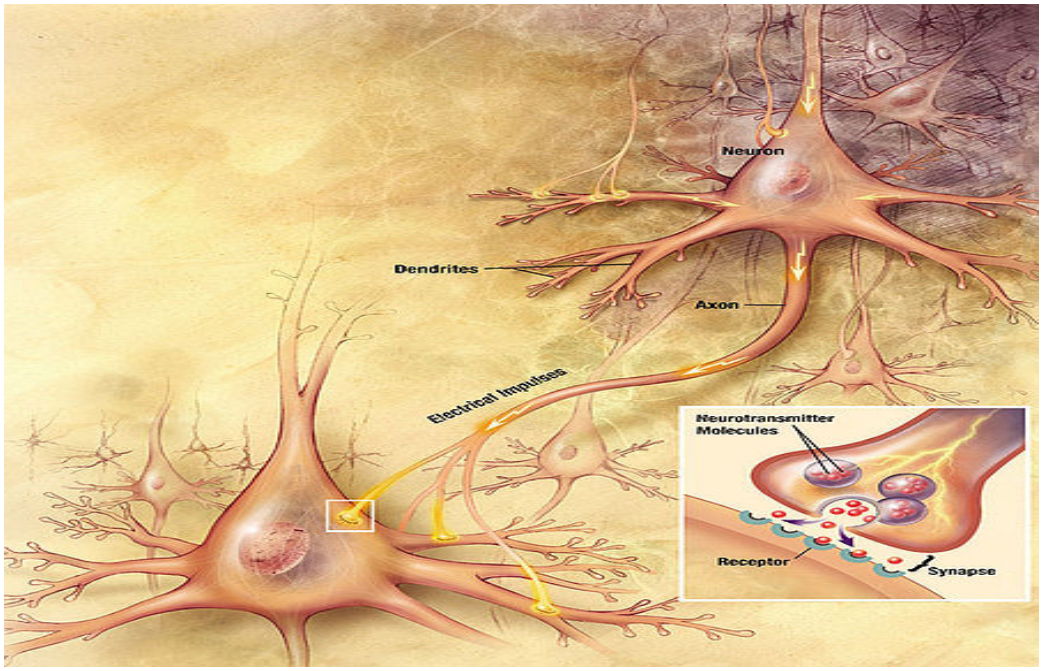
I had never heard this term before, but all of sudden I realized this as the explanation of how change occurred in the brain – I had to know more. In 2002 I was not yet as computer savvy as I am today. I had never purchased a book from Amazon, and yet there I was, on the internet, searching for Synaptic Self. I ordered the book, sight unseen. That book was a game-changer for me. Most people would probably find such a book to be extremely dry (unless one was a neuroscientist), but I just couldn't put it down. Leaping off the pages at me was a way of looking at change that made all the sense in the world. Here I had been working diligently with my own thoughts for years and had nearly completed a masters in counseling, a profession that deals almost exclusively in working with 'thought' and I realized I knew relatively little about how thoughts formed in the brain.

The more I read the more things began to make sense. I was hooked. Since that day I have read everything I can get my hands on that has to do with neuroscience. I am convinced that a solid

understanding of how the brain really works is vital to making **Δ** happen. Of course I discovered plenty of things that I didn't know, the knowledge of which has completely changed the way I understand my work and how I instruct my clients. Knowledge is power.

It never ceases to amaze me how beliefs form in the mind and are simply not questioned. I had never questioned the way I 'thought' my brain worked I just never really thought about it. I assumed that thoughts were this mystical entity that nobody could really pin down, a spiritual sort of entity that formulated, well … somehow.

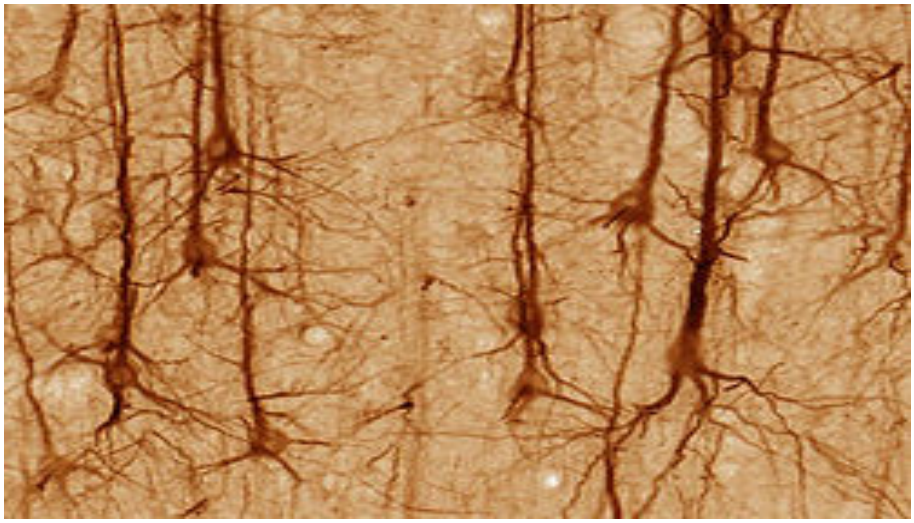
What a learned by reading Synaptic Self is that thoughts really consist of hundreds of thousands of synapses, connected in complex ways in the brain. The human brain houses approximately 30-50 billion neurons, each of which is capable of thousands of synaptic connections that occur at the juncture between two adjacent neurons. As the inset picture below illustrates, neurotransmitter molecules are secreted from the dendrite protrusions and form thought by connecting to an adjacent neuron's receptor site. These neurotransmitters form a 'synaptic connection'. These synapses are created each and every time a thought occurs in the human brain. It takes thousands of these tiny connections to complete a thought. Over the course of a lifetime, one can create a whopping 500 trillion of these connections. That is a lot of cognitive horsepower. Sadly, most folks are doing very little to control how these synapses are being formed.



What is important to note here is that each and every time a thought is formed, a brand new set of synapses is built containing thousands of brand new connections. It may be the very same thought I have thought thousands of times, but each thought is distinct and the volume of thoughts is cumulative. Neurons are fired again and again, but new connections are being made each time a neuron or set of neurons is fired. Each time a neuron is fired, chemical messengers released in the brain encourage the growth of new dendrites, creating more opportunity to form thousands of additional connections with each progressive thought. This is how a thought process grows in

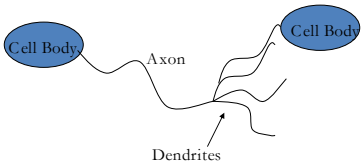
strength. Each and every thought counts: thoughts have physical properties and mass, they get bigger and stronger with each passing thought.

How do we know this? With the advent of modern technology, we can now see things we couldn't even 10 years ago. CAT Scans, PET Scans, fMRI's all add to the knowledge we now have about the brain. Neuroscientists historically have thought that the brain was more fixed in nature, we now know that this is not true. They are actually far more malleable and moldable than anyone could have ever imagined – thus the term ***'neuro-plasticity'*** which literally means that our brains are rather like plastic in the way they can be molded. The tool the does the molding is thought itself. Below is an actual picture of neurons and dendrites showing actual synaptic connections.



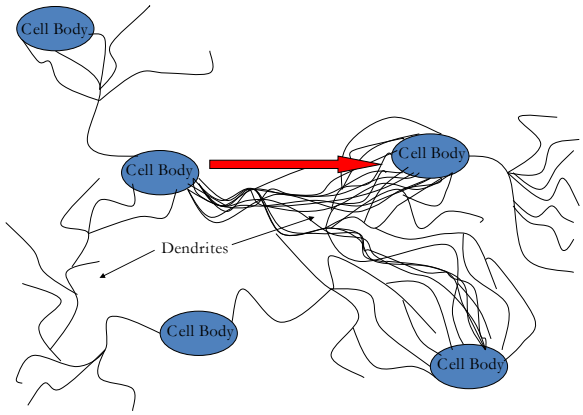
So each and every time a thought is thought, it gains strength and grows new dendrites, poised and ready to create new connections. By the time a person becomes an adult, thoughts can have been used so many times that they are so strong they almost seem permanent. The good news is that they are not. Keep in mind that the brain must obey the laws of physics. Thus, the strongest pathway is going to be the path of least resistance. Our brains will tend to use the path of least resistance every time. Of course we can temporarily force our thoughts down a path of greater resistance (a smaller, weaker pathway), but eventually the brain will default back to the path that has the least resistance.

For the sake of demonstration let's isolate and consider one single thought. Since I get many clients who, when it comes right down to it, have come to view themselves as a failure I will use this thought: "I am a failure."

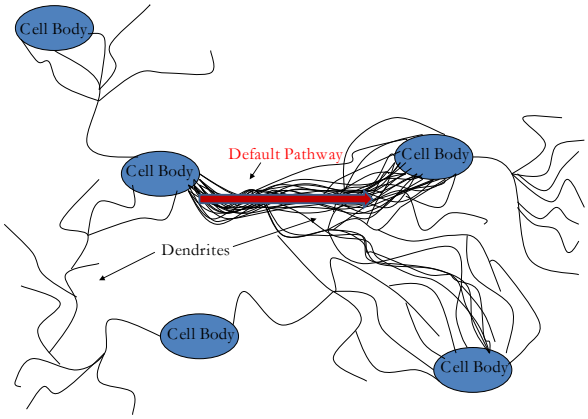


The above illustration represents one thought: "I am a failure." For simplicities sake this will be our working illustration. In reality, one thought creates thousands of connections, but I didn't care to really try and draw thousands of connection. So by definition, the above illustration signifies 'one thought': "I am a failure."

As this thought begins to be a repeated thought, this particular thought is growing into a belief about one's self:



The red arrow indicates this repeated thought that is now starting to gain strength and size as the neurons involving such are repeatedly being fired, new dendrites are sprouting and thousands of connections are being formed with each passing thought. What is forming inside this individual is the 'belief' that he in fact is a failure. A belief is simply the largest collection of thoughts a person has about something. Essentially, a belief is comprised of the thought(s) we have thought the very most.

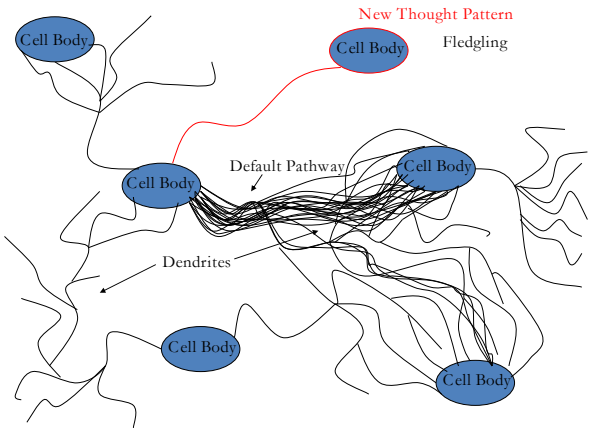


At some point along the way, this thought becomes 'the belief' or in more clinical terms 'the default pathway'. At this point, any suggestions this person makes to himself come from the strong belief that he is in fact 'a failure'. When other people try to assure him he is successful, he discounts this as 'they are just saying that', when successful things happen 'they are just flukes or accidents' because he believes that he is a failure. So no matter what the experience, or situation, his thoughts about it have only one direction to go – down the "I am a failure" pathway.

At this point this person is pretty down and depressed. He may get on medications, which will only serve to slow down the speed with which the synapses can be created and alter the feelings evoked, but a medication will never cause someone to develop a new thought process. There is only one way to do this, thought by thought (the same way the original default was constructed).

What this person is lacking is any meaningful pathway that houses the thought: "I am successful." When I make this suggestion to a person with this kind of thought configuration in the head, the response is always the same: "I just simply don't believe that about myself." And there is little likelihood they ever will until they make some changes to the pathways in the brain.

Now the thing one has to remember is that these pathways are not permanent. This is the beauty of neuro-plasticity. These pathways are only 'plastic' and can be molded differently. Again the tool that does this molding is thought itself. The pathways are, however, quite robust in nature. They don't just simply go away without a fight.

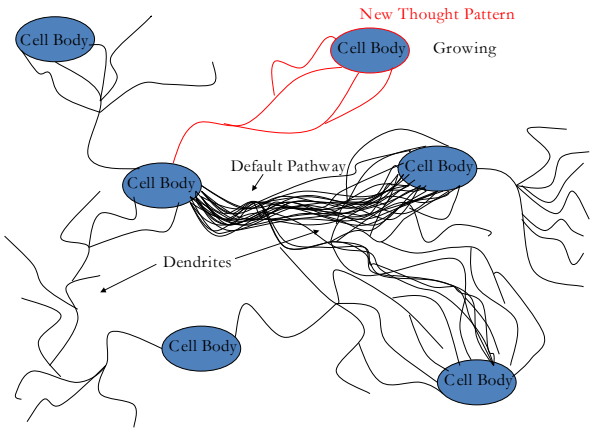


At the point of CBT commencing the above is a simple example of what is happening. Again, for the sake of keeping things simple, this illustration represents one thought (in red): "I am successful." So I suggest to my client to 'think' the thought – "I am successful."

I suppose you can imagine the reaction I get. That is just crazy. I don't believe I am successful and yet you want me to think that I am? Actually, yes, I want you to think it, say it, write it and read it as often as humanly possible. At this stage of the game, the preferred thought (in red), stands no chance against the literally thousands (perhaps much more) of times the default thought has been thought. When this person, with this brain configuration, tries to think the thought: "I am successful", his brain just kicks the thought out as wrong, useless, worthless, etc. Of course it does. That is exactly how the brain is designed to work – to follow the path of least resistance (remember, it is electricity and chemistry). It seems useless and worthless because it really doesn't change anything, right? Well, take a closer look. We do have one red line, don't we?

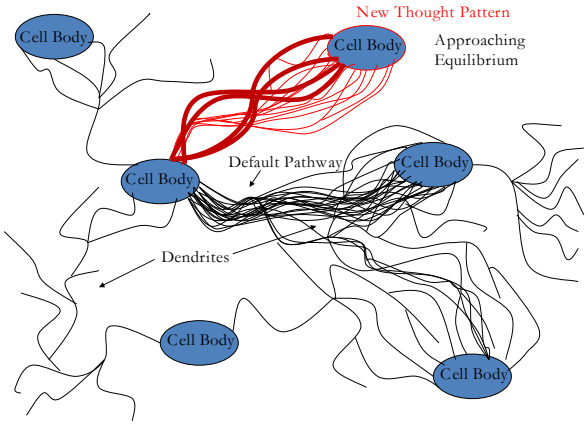
At this point in the process, this person feels like he has done nothing by thinking this new thought. It is literally drowned out by the resounding, powerful, default thought: "I am a failure." It doesn't seem to do any good to try and combat this, it is what it is. What this person is experiencing is what all will at first – those first couple of thoughts (actually in most cases the first couple hundred, or couple thousand) don't seem to do a thing.

And why would they? Compared to the default pathway, one's new thoughts don't seem to be doing a thing.

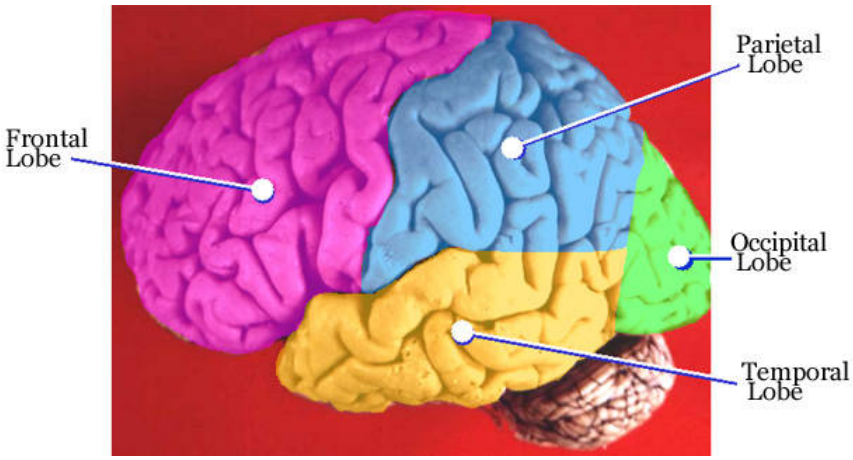


Knowledge of this piece of information is critical. The above drawing illustrates the initial process of 'loading' this new way of thinking into the system. If this person simply attempts to 'think': "I am successful." They are not going to make up a whole lot of ground. The configuration in the brain is likely to continue to be quite lopsided, as it looks above, with the old default continuing to win at commandeering thoughts of self.

If, however, one begins to ***write down*** these new ways of thinking, something remarkable begins to happen:



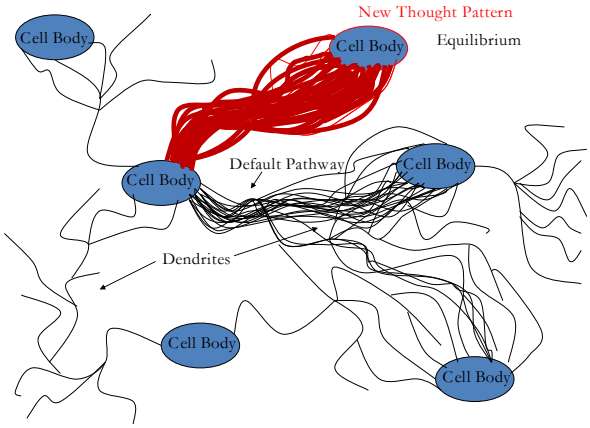
In the drawing above, this person has made up quite a bit of ground by writing. The thicker red lines indicate thoughts that have been written. The act of writing down a preferred thought is nearly 10X more powerful than trying to think that thought alone. The reason for this is simple: it takes exponentially more neural horsepower to create a sentence on paper (or computer or cell phone) than it does to think that thought alone. Writing requires the engagement of the entire cerebral cortex.



The cerebral cortex is the power house of the human brain and is divided into 4 sections, which are known as lobes: the frontal lobe, parietal lobe, occipital lobe and temporal lobe.

The **frontal lobe** is associated with reasoning, motor skills, higher level cognition and expressive language. The **parietal lobe** is associated with processing tactile sensory information such as pressure, touch and pain. It is essential to the processing of the body's senses. The **temporal lobe** is important for processing memory and language skills. The **occipital lobe** is associated with interpreting visual stimuli. The implications for such are obvious.

Stated quite simply, writing unleashes the most neural activity associated with a thought that can possibly be mustered. By making use of the act of writing, typing or texting preferred thoughts, one can literally 'catch up' at ten times the pace of simply trying to catch up by thinking alone.

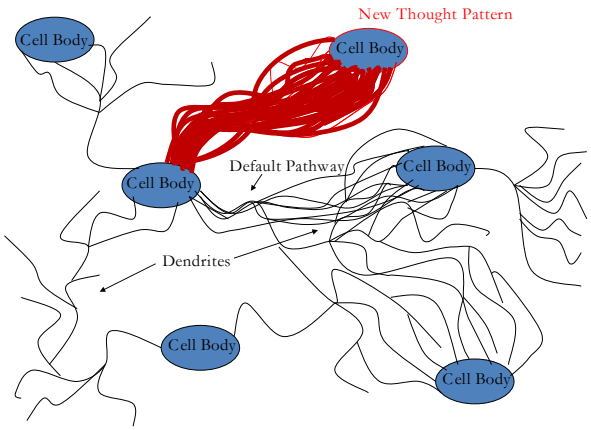


The above illustration shows the brain at equilibrium between the old default thought: "I am a failure" and the new preferred thought: "I am successful." It is extremely important to note that this can take a long time and much effort. Depending on how long and how often one has literally 'thought' the old default, this can take years in some cases. Now granted, one will experience the benefits of doing the exercises in a relatively short period of time, but it would be a big mistake to give up on the writing process before one has successfully built the preferred thought process up

to the point that it can actually rival the old default. Many times people give up way too soon, long before the preferred pathway is actually robust enough to take over. This is the very reason that many folks lose weight and keep it off for several years, only to revert back to their previous weight – and then some in many cases. It is because they gave up on the process long before the preferred path was the new default.

This is the reason that weight loss is not even considered to be permanent until such person has kept the weight off for at least 5 years. In the world of weight loss, it may take 5 years just to reach the point of equilibrium.

The person in the above illustration is equally likely to think "I am a failure" as to think "I am successful." Even after thousands of sentences one might still be equally likely to think of himself as a failure than as a success. Keep in mind that the process also has take into account that one is still thinking plenty of negative thoughts, so the only way to catch up and make the turn is to accelerate the positive thoughts – in writing.



Study the above illustration carefully and you will notice something strange and wonderful about the default pathway – it has begun to atrophy. Just like muscle does, with non-use, the circuits in the brain tend to atrophy as well. This is because the brain is a very efficient organ. It subscribes to a 'use it or lose it' strategy. Once one has successfully channeled more thought down the preferred pathway than the original default, the brain begins to take it apart, slowly but surely.

Proof of this is in the common experience of getting a new phone number. I am 51 at the time of this writing. I was of the age that ushered in the cell phone. My first cell phone was a 'bag phone', as big and clunky as a regular house phone. As technology progressed, so did philosophy. Somewhere along the line, someone decided it was a good idea to 'port' phone numbers to a new carrier or company. Thus, we now can keep our phone number – theoretically for life. Prior to that, I had probably 8 different numbers along the way. At the time that I used each of those numbers, I knew them very well (of course). Now, after more than 7 years of having the same number, I can't even tell you what any of those previous numbers were. The circuits dedicated to 'remembering my phone number' have been officially switched to the new 'preferred' number and the old default has atrophied due to non-use to the point that I cannot even tell you what it was.

This is exactly what we want to happen with the thought "I am a failure" and it has to happen in exactly the same way.

Prior to having this information I clearly did not understand how my thinking changed at the cellular level. Now I am awed and inspired by the process. I have seen it work over and over in my life. It takes tenacity and perseverance to make it happen, but on the other hand it is a relatively simple process.

Even after showing this to folks I sometimes get the rebuttal that they just cannot write down the sentence, "I am successful" if they don't believe it to be true. They are caught in that 'show me the evidence, then I will believe it' mentality. Essentially, they are telling me I have to believe it before I can write it. Actually the exact opposite is true, they have to write it (over and over) before they can believe it.

If that isn't enough to convince one, I simply site the advertising world. Advertisers spend millions of dollars to have as many shots as possible to 'write' the preferred message in our brains. They understand that we don't have to believe something first in order to believe it – that is ridiculous. They work from the platform that we don't yet believe it to be true, and they work hard at expose us to their carefully crafted commercials which are meant to mold our beliefs through the process of (yep, you guessed it) neuro-plasticity. We don't believe that Budweiser is the King of Beers before repeated exposure to the information, belief comes after the repeated exposure.

Turns out that advertisers have understood the biology for many years. They get it, and they take it all the way to the bank.

So I invite you to get busy and craft your own commercials (preferred thoughts) and watch (write them) as many times as you can. This is how change really happens. It is a slow process, but it is the only way. You cannot skip steps. The human brain is governed by math and physics – period. There is no getting around it. The best one can do is to accelerate the process to maximum speed and this is accomplished by writing.