

Dr Arne Dietrich

Where in the brain does creativity happen?

Speakers:

Nick Skillicorn – Innovation and Creativity Expert and Host of Innovation & Creativity Summit

Dr Arne Dietrich

Expert Interview transcript:

Nick Skillicorn: Hello Everyone and welcome to another interview at the innovation and creativity summit 2017, very happy to have Dr Arne Dietrich with me today, Dr Dietrich is the professor of cognitive neuro science at the American institute of Beirut and he is also the author of how creativity happens in the brain, Dr Dietrich its lovely having you here.

Dr Arne Dietrich: I am honored, how are you

Nick Skillicorn: I am very good and apologies if the connection is not the best, I understand you are calling us from Lebanon, is that right

Dr Arne Dietrich: Yes I am here in Lebanon and sometimes the connection is not as good as you expect it to be or want it to be.

Nick Skillicorn: No Problem. For the people who aren't aware of you or what your work is, could you give us a brief background of how you got into the study of creativity?

Dr Arne Dietrich: For my background I am a neuroscientist, as a cognitive neuro scientist and my expertise is leading the neuro anatomy of the frontal cortex, that is all that mass that we have that makes us so uniquely us and that makes us interested in the cognitive functions that I am into also. Two of the things that I am most interested in over the last ten to fifteen years is consciousness and creativity and as a neuro scientist I am mostly interested in mechanism that means how the brain manage these that are created for our species and that is vaguely a unique trait.

Nick Skillicorn: That is one of the reasons I am so keen to speak to you today, we have got a lot of other people speaking about how creativity works for them and other people in neuro science or psychology describing experiments about how creativity can be improved and what situations helps or hinder creativity, but today we are really going to be talking about the cells in the brain and how these amazing instruments between our ears ends up developing symphonies and iphones and concepts about the universe and everything that has to do with creativity.

Arne Dietrich: For me neuroscientist is unkind to common sense and one of the things that I often find is that the kind of things that work on no longer match well with experience keeping hope always of getting neuro scientific explanations that somehow connects with the experience. But

often I work with a lot of explanations that you longer have introspective access to and the mechanisms are quite removed but still I try to make my kind of work relevant to how people experience creativity but that's not what I do in my creative process or in my own creative process, I do not talk about the level of experience but the level of exposure of how neuro structures, neuro anatomy, neuro chemistry and physiology may contribute to us having new ideas about new stuff.

Nick Skillicorn: So the one million dollar question that I am sure is on everyone's mind is where exactly in the brain is the creative part of the brain, I know a lot of people know about the myth of it being in the right part of the brain and there is this distinction between left brain and right brain people. I always tell everyone with the evidence that doesn't work, why don't you give us your own insights as to the structure of the brain and how that affects creativity.

Dr Arne Dietrich: Surely the right brain and the left brain myth depends on countenance and all languages from all kind of people, they come up with misconception, it's not just you but pretty much everybody in the field believes that this is a theory that is treated like nuclear waste and very familiar myths. I think one of the best example of phrenology, when you have a complex psychological function or faculty like creativity, you can be pretty sure that there is no one brain area of thought just like there is no brain area for God or for your political conviction or for your idea concept of democracy and these are functions that are distributed in the brain. So a short answer to where in the brain is creativity as in neuro anatomy as in location the short answer is everywhere. It's a distributed function and it depends on which type of creativity you are talking about for instance if you are a writer and you work with language then you will rather look at language areas and if you are a visual artist like music or in mathematical fields, you will look at different areas, what is much more interesting is the processes that work in this areas, but in terms of neuro anatomy, we cannot be pretty sure in saying that it is everywhere. It is a bit like twenty you can use the satellite, I think that's the best method, you can use the satellite to find things on mars but you can't use a satellite to find out if all the people in the world speak English because they are distributed and that is certainly true for the neuro anatomy or creativity

Nick Skillicorn: I mean that is both great news for people wanting to understand how it works, but it's also scary news for people who are approaching the field of creativity research and for the people watching and listening who want to sort of get the easy answer about what part of the brain is the most active.

Dr Arne Dietrich: The thing is that even if I were to tell you okay creativity is located in some unpronounced area of the cortex it still wouldn't give you mechanism, it will only give you location that still doesn't mean that you understand how it works just because we know where it is. The fact that it is distributed and everywhere still change the fact that we still hunting mechanisms not locations

Nick Skillicorn: One thing that I do want to ask and I don't know if you have the answer to this though is that creativity seems to be a uniquely human trait, there don't seem to be any animals that has the ability to ask questions or think of imaginative solutions even though you might see a donkey with a pink brush painting, it's not the same as a human being painting, is there something about the human brain that seems to be uniquely suited with coming up with new novel solutions

Dr Arne Dietrich: I think that we have a lot of colleagues that would have a problem with saying that animals aren't creative in problem solving and to have some insights to solutions, some of them are

very clever, some of them are very creative but I also don't think that there are very few people would disagree with the statement that there is a gigantic gap between us and the next chimney in terms of creativity, in terms of language and a few other cognitive functions and our ability to be creative the way we are creative since we are just species on this planet that changes just about everything. There isn't any anatomy or priority that we haven't taken with, not in environment we haven't changed. Our ability has to do with certainly the complexity of our brain I think that is the safe thing to say and particularly the complexity of the neuro cortex, the pre frontal cortex in people

Nick Skillicorn: So let's find out then are there basic level for people who aren't neuro scientist, what different parts of the brain do we know have relationship with creativity, a lot of people will know at the basic level what a neuron is, they might not necessarily know what the difference between what grey matter and white matter is or the links between the two hemispheres of the brain, so in your research what do you find at the structural level, what mechanisms do we know about that actually influence creativity.

Dr Arne Dietrich: In terms of grey matter and white matter, white matter is actually called grey in the sense that they are grey and white matter is called white matter because the outsides are myelinated, and myelins are proteins that is white but if you take the two together, you cannot attribute creativity to any one of these two parts or any one network or any one structure, it's to think of your brain as a network of neurons and once you start looking at the network levels and pathways rather than the particular structures, you are getting more to know about how neurons communicate and then again that has to do with complexity, the same way you have information processing in the computer, it is the way the information is combined, it is the way associations are made or you remote a network that helps provide convictions of information's that are analytical, that are new and that creates in the sense that they are also useful. Certainly the more higher up structures contribute more to it areas where the cortex will contribute information that will be numeric in related to that, other areas of frontal cortical areas will be involved in attention processing, so you are going to attend to a problem or it's the opposite, not attentive it to it and then not having a aha moment, not having a aha effect but these processes, attention different types of memory, they are all going into how the information is being processed so that it is confined in a way that it is novel and created and useful.

Nick Skillicorn: I am really keen to find out a bit more about these combination of ideas, because one thing that I am still trying to learn about happening in the brain is I know that during the sub conscious, the brain is taking in all the information it knows and trying out various new combinations between bits of knowledge or imaginative ideas and building out networks, are these just electrical impulses that are randomly going through the brain or is there actual physical new connections between neurons that are being formed and broken, do you know

Dr Arne Dietrich: Yes we do know but your experience as you work might change the structure of your brain which is why your brain looks different from mine is because I have different experiences, but these are processes that take time, quite a bit of a time and for neurons to connect to one another is probably easier and quicker than extra neurons going in and coming, it means neuro genesis, neuro semantic genesis that may be connected. But then in that role is not really physically a new connection, figure it with the terms of let's say all of your friends on facebook and somebody else's friends on facebook and then you have a few notes of information combined but then they

have never been used, so that your network is separated from another network but it is just how the information is rooted and the key cut through some notes to make connections to another network, that doesn't mean you have to create a new note, the note might already exist but it has not been used. Think of a network like that, like millions and millions of connections and connections mean how these connectors are routed from one note to another note and it can flow in so many different ways but you can make new connections without actually having physically to make a connection and in a neuron connecting another neuron via synapses. This may happen, it takes more time but this is probably the most likely mechanism that you have, aha moment, when you have an insight there is a new connection and it's probably not the case because it takes too much time.

Nick Skillicorn: So we have talked about the mechanism of the structure of the brain and how creativity seems to involve all parts of the brain for various different types of creativity. I know in your book you also talked about other mechanism around cognition related to creativity, what you mean by that

Dr Arne Dietrich: One of the most important things that we have to do in creativity research is find the way information flows through a system and that can be modeled and described and the basic algorithm the brain uses in order to come up with new information can be described mathematically in an abstract form as an algorithm and essentially think of yourself as let's say you want to be creative, you want to solve a mathematical problem or you stand in front of a canvas which is completely white and you want to draw a painting, you want to play a piece of music, you want to improvise in jazz, whenever you are in front of some situations like this where your creativity is being required as for necessarily, you can think of this as an unknown solution space, you are in an unknown solution space to hold a point of creating something and it's to create something in the solution in space that is basically where the topography is unknown. So how do you work such a solution space, you are in the middle of it and you have to work something out, you have to make steps towards some solution or towards some things that you like. What you do is to come up with steps and hear out whether they work and you may go and continue in that direction or you take another direction. The entire way of looking at it and can be described mathematically as a revolutionary algorithm, a variation task, a variation selection, generating test algorithm. We can implement these sort of algorithmic functions in a neural network and that's when you see when network starts to become creative in the sense that it comes with a combination of information that might be normal, so the important thing is for us to understand the computational and cognitive processes, so an algorithm will be computation process, cognitive process will be that we need to figure out for what types of creativity do you require more attention, what kind of attention processes, for some other type of creativity it may be less attention processes but either way the way attention figures into consciousness is something that we don't understand well. The same is true for memory, the same is true for perception and we need to have a better understanding what types of creativity goes with what cognitive function and the computational processes that hinder on information computed in general

Nick Skillicorn: It's fascinating you say that because one of the things that just started forming the basics of a lot of the consulting that I do is this idea that the brain is evolved to such a degree that it is now extremely good at spotting patterns and working off memory and essentially working on other patterns and if there is any challenge that it knows the answer to and that challenge could be just drive to work the same way that you have driven to work before or write a letter which is

To find out how Nick Skillicorn can help you build your innovation and creativity capabilities, go to

www.improvides.com

extremely similar to a letter that you have written before and essentially doesn't really trigger much creativity because it just does what it has done before, is that because its more energy efficient for the brain to do it in that way or how do you see

Dr Arne Dietrich: Certainly when you have behaviors that you have adapted useful and you formed pattern, it is much more efficient, the brain is a machine that is already enormous amount of energy, twenty percent of your metabolic routines go into an organ that is only two percent of the body rate, the brain and so yes whenever it can economize, it will. Cooker and divine is the general principle, as soon as the behavior we have the bleak, then we then know the brain structures to work on, that means the , it becomes more difficult to break the pattern an breaking that pattern becomes more difficult the more it in grant and it requires then that you take different parts and that seems to be the one thing that sometimes it's difficult for us, to break these patterns and create something because we have gotten used to doing things one way or another so much and I think great creators have more of an ease with what we would call in the field cognitive flexibility. Cognitive flexibility is essentially the breaking of the patterns.

Nick Skillicorn: It's something that I describe to people as coming up against your comfort barrier because a lot of people if they are asked to come up with ideas, they will list out memories and they would be very easy and feel very comfortable for them but the minute that bucket of easy ideas runs out and they need to come up with different ideas, it starts becoming physically uncomfortable for people, they get anxious.

Dr Arne Dietrich: Also you see this at function at a much young age, the older you get, the more these patterns are becoming great and the more difficult it becomes to break them, it's not a surprise that there is a tendency for younger people to make their true innovations, to break through innovations, the Nobel prizes, the patterns in the heights in any journal at all or certain music theatre or paintings is the younger people that do all that not the older ones. And that has to do with patterns and exactly what you have been saying cognitive flexibility decreases with age.

Nick Skillicorn: So can you tell us a bit more about your research specifically into creativity, what have you found from your research in the field of creativity and research.

Dr Arne Dietrich: Mostly, I have done schematically work over the last six, seven and eight years, the reason why is because the current experimental work is flawed and I have also done most of the theoretical work to figure out where exactly is flawed because some of the creativity tests that have been used in the field might work quite well in other to predict large creativity but cannot be used in neuro science and the reason why is because they commit several errors, one is the first category formation and the other one is the compound construct and because of these two flaws, the tests are theoretically incoherent for us, look at it this way, we are neuro scientist and we have mechanisms, what we want if you have a phenomenal is look at levels of explanations below and not above, it means we want to break down the bits and see what it is made up of, for that we need to isolate the process, if you take creativity test like for instance the(unheard word) test, the main problem is the test doesn't test for creativity as a direct thinking test. We have no idea what kind of processes go into divergent thinking, that is how much attention you need perhaps perception process, the work environment or the reference memory, or schematic memory and these are the things that we can measure , if we don't what goes into the basket there we don't know what comes out from the other end. So part of the problem is we currently don't have a good paradigm to bring

To find out how Nick Skillicorn can help you build your innovation and creativity capabilities, go to

www.improvides.com

people in that and control the paradigm as such we can make influences about mechanisms, we certainly do it better on our understanding of what creativity is and by that what kind of creativity can be clearly distinguished from what other types of creativity. Only once we breakdown creativity into pieces can we then perhaps break it down into more pieces, can we then perhaps get one piece or one chunk and then test this is the function mri. the big thing of creativity in the function mri makes no sense, it is theoretically incoherent and also that work is flawed to neuro science

Nick Skillicorn: Well, in which case why is there so much well regarded and well cited work that the uses of this fmri, for the people who don't know what fmri is, it is functional magnetic resonance imaging and if you ever see a picture of brain with either red or green or yellow or blue highlights on it, that's the output of one of these brain's scanners that shows where in the brain is being activated and there are more and more research over the last couple of decades which is showing where in the brain either more or less activities happening during this creativity exercises, are you suggesting that this isn't actually representative of what is really happening in the brain

Dr Arne Dietrich: Yes two things, one such a high research is extremely successful and very good. This is not critiquing the function mri in general It is extremely good work, but what is of course the triggering part of the doing good functional mri work however is the experimental set up and the set up needs to asks the right question otherwise the function mri is the wrong tool to deliver the answer. Now the creativity literature has actually decreased over the last few years because the critic of it has made it so difficult to continue doing the same thing, that means, it's like a cookie template, at times you take a function mri test, something is not light up, something has to light up. It's a mental test and this is functional mri and you probably should. But perhaps that is not easier to do ten years or eight years ago and now it is much more difficult because we know now why its flawed, so the function mri work has actually decreased when it comes to creativity and there are many many more function mri studies if I think that creativity would have not been articulated the way it has. I think you will see practically a study year everyday and you don't and then it still continues, it has to do primarily almost with people and it has to quite frankly formed an eco change, there are numbers of groups of people that works on this and they continue this kind of work now but this is still a perpetuating thing and they are not yet quite with the plan that the rot has been blown out from underneath them, so they continued with it, there is also the precipitation of people hoping there is still somehow they can do something with the creativity test. So the area has not yet fully died but I cannot see that it wouldn't give the eco system results that come out. You pick up any creativity studies with a function MRI and you get all sorts of results, try it you pick up another study, you get another set of results. You pick up another study, you get another set of results, how are you supposed to make evidence, there is no consistency at all and the reason why is because it's fundamentally and theoretically flawed. I have no doubts that next year we will recognize another three studies and the year after that another study it's just how it works.

Nick Skillicorn: In which case, if these fmri studies is fundamentally flawed, what good research do you think is out there that is actually helping to push the field forward

Dr Arne Dietrich : I think one of the things that is probably the best in terms of functional mri, ug and others is if you take a particular type of creativity and there is one set that doesn't use this test or any of the other parts of the ones next to others where we have the better idea of pin pointing things because they test for a specific part or a specific process, I think the best work on function mri

To find out how Nick Skillicorn can help you build your innovation and creativity capabilities, go to

www.improvides.com

creativity is being done on music not on the eternal abusive test and the one on music is different because it isolates the process and this is in work by certain groups all over , they used jazz improvisation with some other improve kind of set up where they have a control condition which is standard and one which creatively improvise since this is musical, it will also activate completely different parts of the brain then it will also start the internal test work and here it is much easier to process what kind of processes might be involved, so based on this work out there shows that during dance improvisation you have a down rate duration of down rate frontal cortex functions, this is quite There is your controlling system is a bit down regulated and that is also what makes it flow when you do the jazz improvisation. Those are for instance pieces of research that has proven as very good insights of certain types of creativity.

Nick Skillicorn: Is this all the sort of stuff that you talk about in your book, how creativity works in the brain

Dr Arne Dietrich: Yes its part of it, you look at what we have and you have to decide what works and doesn't and I think that what I thought, we get better, a theoretical understanding of the different types of creativity so that when we have the bits and pieces that we can actually look at mechanisms because we have broken the downs all enough to hold on to one particular bit, that is the key part

Nick Skillicorn: So what do you mean by different types of creativity

Dr Arne Dietrich: We can most certainly distinguish the three types of creativity giving what we know about the brain and how the brain works. And they do match well with your experience, you can have one type where you deliberately and systematically solve a problem and you can call it deliberate type if you want to, and that is sort of a particular type of mechanism, Thomas Edison has take this equipment and looked at what can I do with an un improved and turned all the nuts, until he has something new, he has 1093 patterns still directed and expected in the trade mark office, you can also know the other type, this is the type that people mostly associate with creativity, it's the type where the idea just comes to you. It's not a normal methodological or systematic, trying to solve the problem you can and trust it, you incubate it, you go cooking or go take a shower and do something else and all of a sudden it comes to you like a turn of bricks. On the first type that is the deliberate type, you focus your attention and resource upfront that is certainly be a very different type. The second type I described when intentional processes are outlined, you can already see these two types that there must be a search created with completely different references and the third type, the very least is the third type but this three different stage is the best flow and the fourth type is different because it produces fluent mutual output and this by passes keenly consciousness when you ask people in the flow mood, they had created the flow without thinking about it. There is no insight, they did not try, they also don't have a aha moment, they just have a flow moment and this flow give them input, the kind analogy that people record being in that state and certainly going to be a different very type when it comes to brain mechanisms, so these three types are the very least we can discover.

Nick Skillicorn: Are you just describing the difference between convergent and divergent thinking or is there more behind this

Dr Arne Dietrich: No, the difference in convergent and divergent thinking can be seen with or without attention, I will give you an example for instance, you can have a divergent thinking test like

the abusive test and you put all your concentration on to finding the abuses for a certain brake or for a tire, you can also do this for the convergent process, so convergent and divergent you can do both in deliberate moment and you can do both in a spontaneous moment, so they are almost alike, the problem with divergent thinking is primarily that we know that divergent thinking can produce idea generation, we also know that convergent thinking can produce idea generation, so one of the questions that many do ask is what is it about convergent thinking or divergent thinking that is creative because obviously this is logic 101, in quote convergent and divergent thinking can be thought creative or non creative, you would have to tell me what it is about divergent thinking that is creative, it makes no sense, you see that, and that is the primary problem of using the abusive test and the function mri and then making conclusions about creativity, you see the theoretical incoherence to that.

Nick Skillicorn: I find that quite fascinating because it's very different from what the basic level you learn from creativity research, so taking that a step further around this concept of attention, one thing that I wanted to ask you is that is there a research or evidence behind this concept of as you wake up throughout the day, the relaxation or activity level within the brain will change, so you start out with a more healthy state brain and as you focus more you go into a more better state brain, better way of brain is that something that actually happens?

Dr Arne Dietrich: No, that's I think simplification doesn't stand that way, first of all the brain doesn't change activity globally, what changes you have are regional traits, the brain is a fixed container and always gets a certain amount of resources in terms of oxygen and glucose and blood profusion, so you do not have a brain state in a resting state it's a misconception, even though in sleep your brain is the same amount of energy when you are not. What shifts are the resources within, for instance I find better at times useful CG an EG only record activities from the cortex because the electrodes are right in your cortex so it doesn't constantly go deeper down in the brain okay, so when you wake up in your natural state simply because the cortex is not activated and as you go through the cortex is more activated but not the whole brain and that also depends, better activity certainly is associated with information processing but that includes thought created by information processing and normal information processing or whatever that is, but normal cautiousness and normal creative thinking and non creative thinking both are associated with both with beta and alpha again it depends the type of creative thinking you are thinking about and the type of brain processes, you have to find ways to dissect the problems into pieces that can actually be investigated.

Nick Skillicorn: Then finally I wanted to ask you about one of the words which is been around creativity and research which is the default mode network, for the people who don't much about it, could you explain structurally what the default mode network and how can it be described in its role in creativity and what your views on it are

Dr Arne Dietrich: So the default mode network is a thing that has been around for like ten to fifteen years and it's the result of function mri studies that needed to control connection. so if you have a normal cognitive task, you ask your participant to be either on control condition or experimental condition, so what do you do in the control condition, you ask people in the function mri to do nothing. It's just sort of constantly a resting state, all over the years, people of course don't do nothing, and the brain cannot not do nothing. So over the years people have found that particular condition activates set of structure and that's part of the default mode network because it's sort of a

default and it brings back all the brighter cortex out of the frontal cortex and you think of that as a global network because it includes several different parts of the brain, it is related to another network called the central executive network, it has overlaps but if one goes up, the other one goes down and that its associated with whether something is trans dependent that means whether you pay attention to a particular task and tried to solve it or you day dream. When you day dream, your default network is activated and when you solve a problem, your central executive network is activated. If anyone associating one with creativity and the other one not with creativity, it's a false category information, with the example of Edison. if you then systematically solve a problem you can be creative. So your central executive network can also be creative so your default mode network cannot deprive creativity this way you can't nurture the wrong joints. This is a false category information associating creativity with one network and not to with other because of course both do not use the same problem that you have in convergent and divergent thinking and to associate the default mode network with creativity is false and I think we can demonstrate it. We say for instance the default mode network might be associated with a particular type of creativity and in that direction we could work and that could yield something but the whole of creativity associating with the default mode network is false out right

Nick Skillicorn: In this case the last question I want to ask you because we are coming to the end of our interview, is if budget and time issue and researchers in the world could have whatever they need to do their work, what do you needs to happen to take creativity and research to the next level.

Dr Arne Dietrich: I think that the currently the most important next level for us is twofold, one we have to work on the computation processes, that means that in creativity research, we need to involve people in art intelligence, computer science and cognitive science and be much more inter disciplinary when it comes to computer and stimulations because we talk essentially information processing in a network and I think that there is a whole group of people that are not doing or helping because they are not involved in the type of creativity this is one thing, the other thing is that we need to do much better research when it comes to I mentioned earlier three, four times much better theoretical work that will yield to paradigm that we can test, currently we don't have a good paradigm and the creativity result that we currently find are not at the level that I think will stand a test of time because they are not consistent. So by getting our heads together, all of us in creativity research, the most important thing is to come up with new measures of creativity, psychometric tests that test particular type or particular types and then need to be developed and then I think will be better than currently is, it doesn't actually require much money, it require a theoretical work on all education level also in terms of cognitive levels, social levels, neuro science and others to get better testing than we currently have because of the validity of the creativity tests and our inability to use them in a large setting

Nick Skillicorn: Perfect and the last thing that I like to ask all the experts is that do you have one tip or one actionable insights that people watching and listening to this can go out and try either this afternoon or over the next week to become better at creativity and to become better at generating new ideas

Dr Arne Dietrich: I do have a few for myself but I have made the points throughout my life because I get to such emails all the time to dodge their bullet, because I am not confident enough that I can

say something that is probably enough for me in the basic time to certainly understand creativity that is the sculpture Something you can do in order to enhance creativity. I have found for myself a couple of things that work for me, I don't think they have generalized it and allow me to dodge that bullet I will not do this because my area of expertise is basic sciences and now I want to play a conservative scientist that you are used to and that does draw conclusions about what to do and what not to do.

Nick Skillicorn: Perfect we are going to have links to your resources below the video in the description, can you just let people know where's that's going to take them.

Dr Arne Dietrich: My website, it will take people basically to my work, I am scientist so I do experiments, I have therefore publications and they are mostly academic except for my latest book which is written for a large audience but it's still quite technical, I wrote this so my mother could read it who is highly educated but still I think will be challenging for some people, so links will take people to my writings, to my work and academic and my book maximum.

Nick Skillicorn: Perfect, it's been wonderful having you here; I look forward to speaking with you again soon.

Dr Arne Dietrich: Okay, Thank you.