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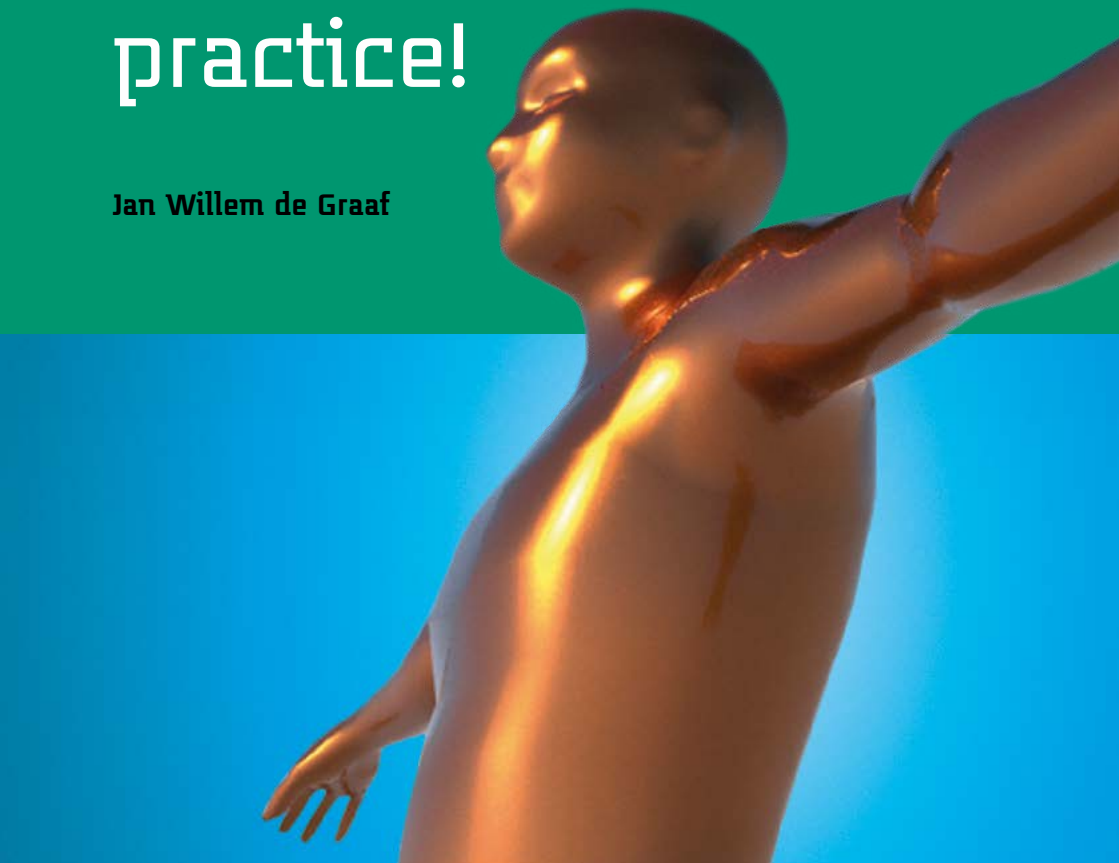
Brain and Technology:

To an argument based practice!

Jan Willem de Graaf



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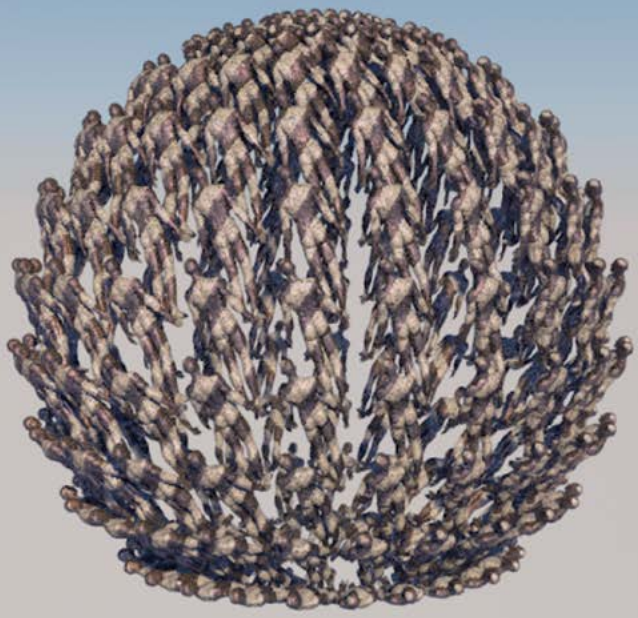
My gift is my song and this one's for you

(Elton John, Your Song)



Odette Fremouw, Human 2

Everything we do is music, art, and applied science ...

Lector. Master. Professor of applied Sciences... I am thinking of the composition "4:33" (1952) by composer John Cage (1912-1992). On stage the pianist takes place behind the grand piano and waits until the applause is extinguished and then closes the fallboard to reopen it exactly 4:33 later. Cage's composition showed that music could also consist of silence: music is a covenant between composer, musician and listener, or listeners. Listening, thinking, arguing, doing, everything we do is what we are.

It is a great honour for me to be "a master", which "lector" means literally. A master may, like John Cage, ask the reader or listener to hear his or her essence. Artist or scientist, a master is both and at the same time neither; it's a unique position. This argument is about what I think, what I stand for and - certainly within a scientific context - perhaps unusually little about what others think and have written down. That's because I feared the argument would get entangled in a bunch of references, while I'm fully aware that the truth is in the eye of the beholder. The reader always gets the last word. As a "master" I can choose form and shape, and so I repeat what I wrote long ago in the preface of my dissertation: "These are my words, not a word is mine". I never managed to be like everyone in general. The best I can do is to show you the world from my point of view, that's where I'm good at. My gift is my song, and this one's for you!

Jan Willem de Graaf
October 23, 2018

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Reading guide and Foreword:
Themes, Methods and Applications.

This argument is based on the TMA model of Applied Science: themes, methods, application. TMA is devised by my wife Dr. Victorine de Graaf-Peters (de Graaf-Peters, personal communication). The idea behind the TMA structuring is that its application in applied scientific work guarantees a firmer connection between practice, science and innovation. Besides I am sure that this argument is much easier to follow with the TMA structure as a reading guide.

A. Themes (T):

1. (smart) technology and behaviour (chapter 1)
2. Dynamics of (brain) development (chapter 2)
3. Biological determinism (chapter 3)

B. Methods (M):

1. Dynamical system approach (chapter 2)
2. Psychological Argumentation (chapter 4), and

C. Applications (A):

1. Learning analytics (elaboration as an example at the end of chapter 1)
2. Dynamic cycle (APK, elaboration at the end of chapter 2)
3. Beta talent (chapter 5)

Summary

Since the emergence of modern man some 200,000 years ago, people and technology have been inextricably linked to each other. However, unlike traditional technology - such as leverage (and derivative applications such as hammers, wheels and crankshafts), and *control of fire* - smart technology is equipped with adaptive capacity. Whereas in traditional technology people have to think and handle in terms of technology in order to apply technology successfully and purposefully, technology with, for example, its own learning ability adapts to humans. This means that smart technology influences development in a different way than traditional technology.

First, the direct physical and logical relationship between what the user does and what happens - the contingency - is veiled by the mediated smart mechanism (for example, a learning algorithm). In this way working with smart technology becomes like working with someone else, a *social* activity. Aspects of mechanical, cognitive, or logical nature

are isolated from the user his/her development of insight. We borrow what we need. But what do we lend, and what do we borrow? New dependency relations arise: social media, for example, can be very addictive. Second, precisely because the smart technology has its own learning capacity and adaptability, it is unclear how techniques are developed. In "living" technology people "lend" their lives to technological development in an implicit and unclear way. Much less than in traditional technology, the user is a part of this. A carpenter or a pianist always had a lot to say about innovations of their instrument. Smart technology can be withdrawn from the market and can no longer be followed up. There is therefore no guaranteed sustainability and no social discourse.

These changes in the relationship between human development (brain) and smart technology - technology with its own learning capacity and adaptability - have led to the articulation of 4 requirements technology should meet: 1. it must be sustainable, 2. it must not block development and if it does it must be clear how, 3. there must be a logical argument why the technique can be used and how it can be explained, also in terms of psychological development and, finally, 4. the social and ethical discourse must be stated in a transparent way.

At a fast pace, futurologists and management gurus are presenting "theories" about how smart technology will change us permanently as individuals. Requirements 1 (sustainability) and 2 (technology influencing human development) are at stake here. However, these ideas cannot be substantiated by scientific research (chapter 1). For example, it is often argued that more and more disruptive start-ups overthrow the big companies and that the internet produces a broadening of the artistic landscape, because artists and writers are no longer dependent on publishers. However, research shows that fewer and fewer artists represent an ever-increasing percentage of all streaming, and that since the 1950s the share of large companies in the gross national product has doubled. The assumed differences between smart technology and traditional technology (and even culture) largely disappear. However, the fact that gurus often find their audience effortlessly is of importance here. It shows that psychology (and the other social and human sciences) have not yet been able to generate a convincing interpretation of what is going on in the area of brain and technology (living technology). In fact, there is a need for argumentation (requirement 3).

In order to arrive at an argument-based psychology, insight into the non-linearity of processes is indispensable. In chapter 2 a dynamic system perspective is explored and practical consequences are drawn from such a perspective. For example, more is not always better, sometimes less is more, growth does not always follow a linear pathway, and many processes have an optimum. However, people think in cause-effect

relationships and in the text various funny fallacies are discussed which are produced by this kind of thinking (chapter 2 and 4). In order to arrive at a real argument-based applied psychology, it is necessary to build up at least an intuition for a dynamic system approach in our way of thinking. The Brain & Technology research group is exploring the great possibilities to bridge the distance between people and their limitations by using smart technology, or possibilities, especially when it comes to argument based applied psychology!

Arguments must explain and incorporate "evidence". Arguments form the basis for understanding and showing directions for further development (requirement 3).
In practice, however, it often happens that evidence is supposed to speak for itself. Argument and also discourse (requirement 4) often lag behind. In this document, mainly the argument requirement is considered, because in the rapidly changing technological processes, the argument often does not sufficiently develop and the argument lies pre-eminently at the level of applied psychology, brain and technology. In addition, the lack of argumentation is often the cause of inadequate technological sustainability (requirement 1) and undesirable blockage of psychological development (requirement 2). The fourth requirement - the discourse - is largely outside the scope of this argument. However, in chapters 1, 3 and 5 a "box" is included under the title "Putting out the fire with gasoline", in which special emphasis is placed on the level of the fourth requirement. The discourse deals with which morality is (implicitly) fixed and seen as truth. The 4 requirements loosely coincide with the four-part division in information theory: 1. Data, 2. Information, 3. Knowledge and 4. Wisdom.

Chapter 3 examines the flexibility of the psychobiological system (the brain component). It is stated that man is, as it were, "devised" to deal with a great many different technologies and cultures without needing any biological (genetic) adjustments. Cultural adaptations (technology) made it relatively unimportant that the genome of humanity is rather narrow. For 200,000 years, culture and technology have served as a sort of shield that protects people from both biological changes and human evolution.
This results in a controversy: while technology and culture have lessened the need for evolution, the impact of technology on people is smaller than would be expected due to the narrow genetic basis. Again, a dynamical system! As a consequence, requirement 1 and also 2 become relatively subordinate to 3 and 4. In chapter 4 the human reasoning capacity is further investigated. It is concluded that thinking according to a dynamic system perspective (as elaborated in chapter 2) has not been given to us by nature.
In order to arrive at a good argument, however, dynamic system thinking is a necessity. Finally, chapter 5 forms an application of especially requirement 3 (argumentation) to our research project on autistic talents in the context of labour: Beta talent Forward!

Acknowledgment

Thanks to the many people who have paved the way to this research group with me, some of whom are now working hard within our research: Marco, Sjoerd, Mijke, Elian, Elsbeth, Trea, Diane and student assistant Annefieke.

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Finally, thanks to my wife Victorine, without whom I do not know who and where I was, and my children: Camiel, Odette, Cameron, Thorvald, Deborah and Dorinthe. My daughter Odette Fremouw made all the images, Thorvald, Deborah and Gerard Kok together form the blog editor. Thanks for everything!

Odette Fremouw,Time Flies

1. Technology: 4 requirements

Sometimes I dream that after driving away I find that the road network management has changed all signs at night. For example, the priority sign means stop, a yield line means you can just drive. Waking up, I realize that car parts and hospital beds would be "sold out" quickly. In my leisure time I play guitar. On my smartphone, I have an app - *Guitartuner* - that produces a beautiful A of 440Hz. Everywhere I go I tune my guitar (or bass) on the tone generated by this app. To me it's a handy tool. There are tuners in the stores that can be clipped on the head of the guitar, indicating whether a string produces the correct pitch. However, the hearing of the musician is eliminated here, and the tuner is certainly not precise enough, because tone depends on many more factors than just the pitch of the loose strings. Now I am a very careful person when it comes to updating my apps (I usually skip updates consistently), but last Saturday when I was in the studio to complete recordings for a new CD, I found out that my digital tuning fork had been updated to a perfectly working chromatic tuner, but without tuning fork. The ears of the musician are now completely out of the game...

One moment you have something, the other moment you've lost it. Digital technology is beautiful but, unfortunately, also incredibly unreliable. Imagine, after a night of good sleep, you enter your car where you find that the brake pedal is on the right and the accelerator pedal on the left. An update, with kind regards, Volkswagen.
Or that the manufacturer of your piano - for example Steinway or Grotrian Steinweg - decided to do an update, inverting all the keys: on the right the basses and on the left the high tones. You may object that this would never happen. If that is true, why does this happen almost continuously with updates of apps?

Humans assimilate handy pieces of tools in their action repertoire. During development we learn to work with it. A person adapts to the possibilities and limits of such a tool. Eventually mastery arises. However, if the tool constantly changes, mastering and developing skills disappear into the background. Apps aren't skill-centred but technology-centred. Of course it can be didactically very good to use a tool temporarily "differently", for instance to play guitar with the non-dominant hand, or to use the hockey stick the other way around. From the disruption this evokes, sometimes a "breakthrough" can be forced into "normal" use. But sustainable development is virtually impossible if the sustainability of a tool or a relevant aspect of it has become a question mark for every update of the app. My grumbling about the lack of a good voice tone didn't make the atmosphere good at the recordings. As good and bad as it went, I tuned my guitar on the recordings of last Saturday. During the break I decided to visit the music store. I asked for an ordinary, old-fashioned tuning fork. You guessed it: sold out!

1.1 An application in our lab: Make smart devices, or make people smart?

In the introduction we've met a first criterion/requirement: technology on which we base our development must be sustainable. A second requirement, closely related to this first, is that technology must not block our development (keep us from getting smarter). People are increasingly living in a "machined" reality. To keep a car on the road, the driver should accommodate, to be assimilated into the physics of the car and the system of which that car is a part (cars require highly pre-prepared surfaces/ environment). People can accommodate. With each new application or device, technique is critically dependent on whether or not the user can learn to work with it. If it requires too much adjustment at once, it does not work. However, technology is increasingly equipped with accommodation capacity.

For example, by analysing my mouse clicking behaviour, Google "sees" my topics of interest , and suits the ads and suggestions for further reading (or watching) on that, with the result that I live in my own information bulb. But it is still human who is the master of adaptation. Our virtual reality - our information bulb - is constantly accessible for instance through Facebook, and consequently we adapt to that. But to what costs? Now the question becomes: should technology (devices) become smarter (adjust to individual needs, e.g. by pattern recognition or bigdata), or should we use technology to create smarter humans?

From your internet behaviour (click and viewing behaviour; the "digital crumbs" left on the web), algorithms derive your preferences and allergies and link them to more common patterns. This way you are linked to segments ("islands in the data sea", see 1.6). Based on this, you are presented with selected messages, or you will be "paired" with people who may be of interest to you. Far more easily, this allows you to develop in the direction of your interest. Also for advertisers, this is interesting, because advertisements may be personalized. Actually, such algorithm is not intelligent. It constructs matrices and subsequently, by segmenting the data, it searches for coherence and correlations in the matrices. In this way, an ever more accurate estimate can be made. Of the segment (island) to which you are associated with respect to a particular criterion, all kinds of statistics (average, distribution etc.) are known. Thus, various features can be "determined", including your intelligence, your political preference, your sexual preferences, various personality traits, etc. Of course, this happens by comparing your "crumbs" with various "islands". Advertisers are interested in those features to promote and eventually adapt their products. With my team, among other things, we create and work with these types of algorithms for the purpose of determining different learning strategies or working styles that can be taken into account by professionals, for instance in education, or in designing the workplace. Children and adults with autism,

for example, learn differently from non-autistic (*neurotypic*) people. If it is taken into account, autism does not have to block a successful and/or happy life (more about later). However, the data we are allowed to "use" is very limited; much of our research is closely linked to medical ethics committees and their objections.

That is remarkable. Why? Commercial companies like Google and Facebook are allowed to use every little slot, even deleted typos. Their goals are not pure honest (selling), while unintended people get into an information bubble through the intervening algorithms and matrices. Someone with, for example, more conservative political preferences, lives in a completely different Facebook/internet environment than someone who has progressive preferences. On basis of your "digital crumbs", the algorithms select what you will see. It is quite possible that you will accommodate to a certain "configuration of segments" increasingly better. Your development is inadvertently directed in a certain direction. In the worst case this can lead to a vastly divided world, full of conflict, which confirms our own prejudices. Are we isolated in our personalized information bulbs?

In short, smart technology with built-in accommodating capacity, offers great possibilities but also great dangers. It is remarkable that digital (algorithmic) surveillance is applied on a large scale almost without caution, while it is almost impossible to explore and develop similar techniques in the context of education and healthcare with professionals. Again, a restriction of smart technology is that it can block or even disturb development. Netflix, for example, "helps" my viewing habits by offering me suggestions to select items of my interest from an almost infinite offer. Consequently, it is hard to develop new interests outside my frame of reference. Education is always about exploring new horizons. Both in education and healthcare, we must use smart devices to help people develop, to create a utopia with smart and happy humans. However, we must prevent the opposite from being achieved.

1.2 Personalized information "bulb" or globalized tunnel vision?

So now we have two requirements: firstly, smart technology must be sustainable (because we partly base our development on it) and secondly, this must not prevent us from becoming smarter. To state the third requirement, we focus on the following question: Are we living in our personalized information bulbs, or do the powers of smart technology uniform our cognition and vision into a global one?

Richard Engelfriet shows in his book the Success Illusion (2017) how futurologists mistakenly claim that we are evolving towards our personalized versions of the world, in which multinationals are disturbed by a still growing number of disruptive (smart) start-ups, that form both "the long-tail" and the alleged information bulb.

In 2004 physicist Chris Anderson postulated a theory in which he stated that with the emergence of the internet many writers and artists get a chance of success. As a result, greatest hits and bestsellers would have an increasingly relatively smaller share in the totals of artist success. He states that through the internet the production costs of, for example, books or a music albums have become so low that (1) many more artists and writers will publish their products, and (2) successful niche markets will arise. He calls his theory the long-tail. If the "sales figures" (or streaming figures) are plotted on the y-axis, and all "products" (releases) on the x-axis, after the first high (steep) hill (the superhits, or blockbusters) there will be a very long tail, which will become increasingly higher, because the products in the tail will be discovered as "niches". For example, Aslander and Witteveen wrote in their book *Nooit Af* (permanent beta, 2015) many pages about this phenomenon, which according to them already caused "disruption" of the existing markets. However, their "evidence" consists of a few companies (*Uber* and *Airbnb*), which are rather big companies nowadays.

However plausible the long-tail thought may sound, it is simply not true. In fact, the opposite is actually the case; there has been a movement for at least 10 years in which fewer and fewer products (hits, blockbusters) have an increasing share in all success. How does this work? Already in 2008, research at Harvard University of Elberse shows that "Although no one disputes the lengthening of the tail (clearly, more obscure products are being made available for purchase every day), the tail is likely to be extremely flat and populated by titles that are mostly a diversion for consumers whose appetite for true blockbusters continues to grow." (p9).

Now, ten years later, this observation has been frequently confirmed in empirical research into the streaming of products on the internet. In these studies, in which algorithms are used to measure the streaming frequencies of products Zhong & Michahelles, for

example, conclude in 2013: "Our results suggest that Google Play is more of a "Superstar" market strongly dominated by popular hit products than a "Long-tail" market where unpopular niche products aggregately contribute to a substantial portion of popularity." (p. 499). As far as YouTube is concerned, 80% of the streaming only concerns 10% of the repertoire. Blockbusters and superhits (apps, games, music, books and films) are still making a growing part of the total "turnover". In other words, obscure niche products can be distributed more easily than ever before, but remain out of sight until they are "accidentally" discovered and picked up by the blockbuster channels, which now have more power than ever before.

All of this has consequences for how we look at the psychological influence that the internet has on individuals. The idea that the social media algorithms are used in such a way that every user would end up in an information bulb probably does only apply to a limited extent (especially with regard to Facebook friends). Maybe on Facebook, YouTube or Instagram we have a personalized version of the world, in which we live among "equals" in thinking, doing and letting. However, also here the superhits (and super memes) and blockbusters are the same for everyone. In addition, Facebook also employs smart people to create and design - among other things - memes that easily break through every circle of friends (Nguyen, 2017). This serves as a modern version of a centralized news editor, which provides the local newspapers with standard professional content. Paid messages - advertisers - are reconnected here and are guaranteed to reach a large audience (King, 2015).

So there is no artistic disruption, no more than an entrepreneurial disruption: small and fresh start-ups that "challenge" big companies are a fairy tale, 90% of all start-ups no longer exist after 3 years and only in America, 50 years ago large companies made 35% of the GDP, now that has more than doubled (72%). From time to time, newcomers sometimes succeed in taking over parts of the market, like Ford did 110 years ago from Wagoneer and the Mafia from previous syndicates (Uber - operating outside the law, exploiting people). Or a new pop star, who first spent a few years in the long tail. Finally, some personal and therefore exemplary "proof" of a monopolized mark. At Spotify I still get, while I listen to modern composers, suggestions to listen to angry rapping men, while this music really does not make me happy and Spotify cannot possibly ever "caught" me listening to that music. On Netflix I get - while I like to watch British and Scandinavian series - suggestions for mostly American blockbusters, because I looked at "Sorjonen" and "The Bletchley Circle". Psychologically, we may have gone just the opposite direction. This means our personalized information "bulb" may very well turn out to be a personally packaged globalized tunnel vision!

Box 1:

Get ready for a smart world

The world is changing. While we are concerned about which party we have to vote for, we do not realize that not eligible "parties" increasingly determine what we do most: the high-tech multinationals. In fact, we organize our education in such a way that we can adapt to their products optimally. From an early age we teach our pupils to work with the products of manufacturers like Microsoft, Google, Apple, Samsung, and Facebook. In their slogans they often claim that they shape and produce our future. And indeed, they do! Even in (higher) education, too easily "smart" is understood as being well adapted to the products of the tech giants. And because of globalization, these multinationals do have the politicians in their power, including those that we vote for. What's up with that?

To start with the latter, if a technology multinational (or bank) doesn't like the choices of politicians, it can move its head office or the production lines to a country where the political climate is perceived as more favourable. The ambitions of multinationals are literally and figuratively limitless. Not only are they the secular rulers who marginalize democracy, they also leave behind traces of social consequences (loss of employment, unemployment) if they leave a region, putting the burden on the shoulders of the local societies and populations. Politicians can never do it well. They get the blame if a large company moves its business to another country; they should have created a better political climate. But if a company is "bribed" to stay by adapting the regulations, it is also their fault, because they do not limit the power of these multinationals.

In Western Europe, our ambition is to be a knowledge economy. That is why we want to keep our top talents in the region. But top engineers, technicians and economists easily disappear with the multinationals (high-tech, banks); they follow the multinationals who are guided by their opportunistic pursuit of the most favourable political climate. Closing the borders (Brexit, Nexit) is a possibility, at the risk of putting the country out of business economically. Nevertheless, politicians remain credible and stand up for democracy and against the unrestrained power of the multinationals.

In my opinion, a simpler solution is available: investing both in art and culture, and even more in education, healthcare and construction. Since time immemorial, art has been the conscience of generations. Although art forms are among the first signs of human civilization, art as a reflection on human action is so very important especially now. It holds a mirror to society and asks questions. Why do we do what we do? Why don't we see that using more technology doesn't automatically make us happier? Art teaches us that sometimes less is more. Investing in education, healthcare and construction is investing in local economy and society. At least, if the educational credo "get ready for a smart world" (the credo of Saxion University) is perceived as more than an uncritical adaptation to the latest products of the high-tech multinationals. Getting ready for a smart world should be a social enterprise, with art, reflection and meaning in the heart of society, side by side with Smart Technology and social health care. We should care for each other. There are also many top talents in the care sector, tied to local communities, for example in hospitals, nursing homes and other care centres. That's how to keep top talents in the region.

Getting ready for a smart world should be a social enterprise, with art, reflection and meaning in the heart of society, side by side with Smart Technology and social health care. We should care for each other.

Anyway, ICT-skills are often mentioned as one of the main objectives of modern education. However, this isn't as obvious as it sounds. Unless ICT skills are equal to learning to recognize and deal with the social and psychological consequences of an often uncritical acceptance of the dogma technology is good. Take note, "technology" and "future" are often mentioned in advertisements in one breath. Getting ready for a smart World is more than a technical matter. In fact, it is primarily a social matter. Again, in their marketing activities tech multinationals often state that technology is the future. Of course, technology has brought great benefits in addition to potential threats. But why do even educational institutions and universities seem to be so uncritical in strengthening the powers of the most powerful?

1.3 To an argument based practice!

So technology does not necessarily lead to personalized versions of the world. Rather it is (implicitly) unifying our cognition and emotion. A third requirement has to be met: smart technology must be explainable and therefore its application must be also investigated in an argument based manner. In this section we focus in more detail on this. Modern data-mining and machine learning algorithms are used in many disciplines. In the newspaper I read that data driven criminal investigation in France does not yield better results than classic detective work. But ... has justice ever worked non-data-based? It is not to be hoped. Let us try to propose a method that is not data-driven. Based on fairy-tales? In the Middle Ages, women with red hair were sometimes associated with adversity (illness, failed harvests, etc.) and sometimes ended up as witches in the prison (or worse). But even this is data-based: the empirical perception of red hair. Consequently, "justice" stopped with witch prosecution when the hoped-for results did not occur. Again: data driven. The newspaper article refers to the use of data mining and machine learning. Now it appears that in France, where the police have been working with data mining algorithms for some time, the number of solved crimes compared to old-fashioned detective work has not changed. But that does that mean that data mining has no future?

Of course not! Data mining is by definition data-based. A bad database gives unclear and therefore unrecognizable / unworkable patterns as results. In other words, in the last resort it is always the story, or argument that for example connects a machine-learned pattern with the increase of insight. Consequently this insight may lead to solving a problem, for example catching a crook. And frameworks / arguments are fed with data. In data mining, the data "speaks" back, as it were, by manifesting (sub) patterns, which were not yet visible within the conventional framework on the bare side (read the trained approach). These patterns must then be given a place in an adjusted version of the argument. A few examples will illustrate this.

From cash withdrawal behaviour at ATMs (time of day, location of the machines and knowledge of withdrawal statistics on other days), a dip in the behaviour can sometimes be connected to a delayed train or a rain shower. Also the altered search behaviour of a young woman on the internet can sometimes be linked to a not yet discovered pregnancy, or the search behaviour on Google with a spreading flu epidemic. In a study by Tandera et al. (2017) the machine learning algorithms based on the user profiles (and other data) from Facebook were able to predict the personality within the Big 5 personality model (story / argument) with the average accuracy of 74.17%.

In data mining, the limited scope of evidence-based practices becomes so clearly visible; in the patterns and sub-patterns it generates it gives a need to make an argument (narrative) with which causality and coherence can be distinguished from each other. A treatment in which 70% of the patients (or pupils) are better off (or something of a kind) is evidence based, but a data mining algorithm will also discover a subgroup that does not benefit from the treatment (e.g. 20%) and a sub-patterns with a group that gets worse from the treatment (or didactics) (10%). Putting these data into a (tentative) argument will show that different data is needed, for example whether the disease has already been treated before (no effect), or even often (negative effect).

Faith in data itself (without argument) is of the same order as the belief in the link between hair colour and adversity, or between black cats and misfortune. Perhaps it is even disconcerting that with "superstition" just as many crimes are solved in France as with traditional detective work. But let's assume that the experts in the field of data mining are competent at the French police and therefore have carried out the data mining in an argument-driven manner. In the discussions about the possibilities of machine learning and data mining, the influence with data recording system (cameras with face recognition, for example) is confused with the (pure) data analysis. Measurement as an intervention can be very effective. Naturally, social point systems (Facebook likes, assessments, etc.) are also based on this idea. It concerns behavioural influence.

Every solution, whether it is a treatment, a didactic, or bringing a criminal to justice, is always based on two things: 1. data and 2. a "story", which serves as a framework or argument. In the context of such a framework, data can be transformed into information, information in knowledge (the constantly adapted story) and knowledge ultimately into wisdom, a transcending "generality or truth". No data without a framework, and no framework without data (or evidence; even a fairy tale must be able to be connected to countless "factualities"). It is perhaps time that we realize that only looking at the facts is impossible. Our point of view always stems from a framework - a "theory" -that transforms data into facts. With evidence-based practice, the framework is (temporarily) proven by the facts. This is why we should pay more attention to the framework (theory) and transform from a purely (therefore impossible) evidence-based practice to an argument based practice!

1.4 Machine learning and Facebook

In this paragraph we look at an example of what we've called argument based practice, in connection to the 3 requirements smart technology must meet: 1. It must be sustainable, 2. it must not prevent people in development and 3. it must be argument based. Behaviour of people on the social media can be measured and linked to results on (psychological) tests. One of the most famous examples is the research by Youyou et al. (2015) in which they relate the giving of likes on Facebook items with the 5 characteristics of personality traits of the Big 5 personality model: extraversion, kindness, openness, accuracy and emotional stability. What is needed to allow a machine to "learn" which liked Facebook items contribute to which aspect of personality?

Firstly, items must have at least 25 likes, preferably considerably more. Secondly, we must have all the likes of many users as well as the results of a Big 5 personality test. The personality test is the starting point, because the machine (the algorithm) is supervised from this data. People who are extroverted, for example "like" items with splashing action, and more static images are not (or something random). The algorithm establishes a simple equation:

Kindness = a (item-x) + b (item-y) ... zn (item-n)

This is called the least absolute shrinkage and selection operator (Lasso) algorithm. The coefficients (a, b etc.) in the equation can have a positive or a negative value. Valuation of picture item-x, or event item-y is positive, or negative, with the property kindness. Precisely because there is a lot of data, the algorithm can estimate quite accurately which items charge positive or negative on each of the 5 alleged personal characteristics, and which properties do not really matter. The coefficient is set to 0 for properties that do not appear to do, or only a little bit. Of the properties that do matter, the coefficient is then systematically strengthened. In this way, the algorithm thus constructs, as it were, a series of items that may or may not be "like" as an alternative version of the personality test. The number of components in the Lasso equation is limited: coefficients above a certain value (criterion) are "strengthened", set below a certain value to 0 and thus removed from the equation. The criterion can be determined on the basis of the maximum number of permitted components.

Youyou et al. showed that from 70 likes the algorithm could predict the personality better than friends, from 150 likes better than family members and from 300 likes even better than the test person himself. Of course, this only works for items that are very much shared in the social networks and when the results of the 5 subscales of the Big 5 are known from a large group of people. However, there is the danger of this type of research, the fit never gets better than the model that applies as supervisor, so here is the Big 5 personality test. The fact that the Big 5 was ever designed using Likert-scale questions that have been arranged through a 5-factor analysis model, contributes to the distinctive character of the 5 subscales, but does not say anything about the reality of the personality structure. Precisely because the Big 5 originated on the basis of factor analysis, it is not surprising that the 5 items are fairly distinctly related to other patterns of human behaviour.

However, it would be a fallacy to find a justification of the personality model in finding correspondence between the 5 personality factors and clusters found by pattern recognizers. We do not know whether someone is, for instance, really introvert or extrovert. Why wouldn't someone be able to possess both characteristics at the same time (dependent on the context the first or second is dominant)? Do the traits change over time, or even, what do they exactly mean? The machine learning algorithm does not know the person better than the colleagues, the friends or the person themselves. "Only" after sufficient "supervised learning" trials (iterations), the machine is better at determining the correlation between the click behaviour on Facebook and the scored Big 5 factors better than individuals. Prediction replaces the Big 5 questionnaire. But we are not getting closer to the personality of people than with the Big 5 questionnaire. Garbage in stays garbage out. In the end psychology remains a subject of the story, of the argument, even though data mining can help enormously!

Box 2:

Carpenter!

Imagine, hammers and saws that autonomously create architectural masterpieces, in which people can also have a pleasant stay. You find it hard to imagine anything more than an added episode of a Walt Disney movie ("the beauty and the beast")? Then you'll understand my surprise recently, when I attended a (para-) medical conference, where some healthcare professionals seriously said to believe that AI systems such as IBM's "learning" computer (Watson) will at least partially render physicians superfluous.

Since time immemorial, our ancestors have had tools. And indeed, a hammer is stronger than a human fist. More generally, together with the control over fire, an enormous reinforcement of our human forces and speed stems from the use of levers and moments (physics: the moment). We have artificial "arms" in very different forms (from classic levers to pulleys, from wheel spokes to crankshafts). Language - including logic, mathematics and data - is even a more powerful tool than fire and levers. But a learning algorithm finding patterns and generating predictions from a large amount of "available" data, given the most desirable outcome, is not a physician or a physical therapist, any more than a hammer is a carpenter.

In machine learning, people - physicians and physiotherapists, for example - stay responsible for defining both the available data, and the desired outcomes. Lots of thinking, experimenting, knowledge and insight are necessary. And the growth of knowledge and insights remains both critical and constantly dependent on developments, and therefore on professionals. Professionals need to interpret (new) patterns, or qualities of predictions in specific contexts; they need to decide what to do in any (general or specific) context. The quality of our work can increase through the use of tools. However, through blind trust it can also lead to terrible excesses. In innovation there is always a justified fear of the consequences, which cannot be overseen in advance. But with improving the tools in construction, for example, the total turnover of the construction industry has increased enormously over the past few thousand years. Owning a hammer and saw doesn't make someone a carpenter. If AI becomes more of a part of the medical profession, the demands on the doctors become even higher! In short, doctors and physiotherapists will not be redundant by using machine learning, but at best, even become better professionals, with an even greater contribution to healthcare.

The quality of our work can increase through the use of tools. However, through blind trust it can also lead to terrible excesses.

1.5 Islands in the data sea: with data science to an argument based practice!

At last an example from our own research. Modern data analysis offers the possibility to investigate people's behaviour in a personified manner. This is due to a) sufficient computing power, b) a lot of available data ("big data") and c) smart algorithms. It is possible to search for sub-patterns within datasets (populations). For a higher education organization, we made algorithms that searched for patterns in the available data, including school grades, number of opportunities per exam, number of ECTS achieved per period, whether or not information was searched on the Blackboard systems, etc.

It turned out that what we called "islands" (sub-profiles) of students existed in the "data sea". One such island (subgroup of students), for example, passed (almost) all exams at first chance. However, the average of all their grades was around a 6.4. On the other hand, another "island" turned out to be populated by students who needed almost twice as much time to graduate. They re-enrolled a substantial part of the exams. However, their average was around an 8. Considering only the grades, they are excellent students. With the inefficiency and sluggishness taken into account, they are probably far less recommended. However, they are persistent. By only looking at one figure (the grades) - linear - you do not get to see the high achievers who perform well and quickly. Considering grades one-dimensionally, for the highly efficient students a master's or PhD track is out of reach, and that is a huge waste of potential talent (and also an overvaluation of mediocrity).

The islets were discovered via algorithm. First, new data was generated from the existing data in the matrices. For example, every student was given a factor that represents the number of opportunities for taking an exam. As was stated before, it turned out, for example, that there were students who passed all the tests at once (the factor number of chances close to 1 - the average number of times needed to obtain an exam - but this minority of students turned out to have a lower average than students who had the chance factor high). Other students re-enrolled a substantial number of subjects (factor chance is significantly higher, e.g. at 1.4) and eventually had an average that was significantly higher 7.3). There were also differences in the study tempo (ECTS): some students only obtained 40 out of the 60 credits (factor realization 0.66) while another "island" contained students who even got more courses (and thus credit points) than the norm (68 instead of 60 ECTS, factor 1.13). We then made an algorithm that looked at the progress of figures between tests and retests. It is to be expected that with a course that depends on competences - complex skills - the average results of a test and the retest are on average (taken over all students) closer to each other than with testing and

retesting learned facts (knowledge domain). After all, a complex skill - e.g. ball skills of a sportsman, or the bowing of a violinist - is a sustainably acquired competence. She will not just become much better. A knowledge test can be made much better after someone really goes for it.

Our algorithm detected the improvement ratios and if it was significantly different for a subpopulation than for the rest of the students, we looked for common factors within the "deviant" group. If a course was registered as complex skill, but the improvement ratio was high, the course was either wrongly called a complex skill, or something else was going on (cheating with the results, for example). Occasionally, belonging to a specific class turned out to be the distinctive feature of too high an improvement ratio in a pattern that was otherwise modelled as a complex skill course. At that point we stopped our research. After all, addressing specific lecturers on their assessment behaviour with fairly complex algorithms such as "pattern detectors" was not what our client had intended.

However, these techniques certainly have a future. "Islands" can also stand for specific people / patterns within the lifestyle domain. By using smart analysis in the lifestyle domain, I suppose, it will appear that, for example, some "islands" (profiles) of people benefit from a low-carbohydrate diet, but some people may not at all. Let's turn it around. There are undoubtedly people who benefit from caffeine. Or others may benefit from eating fat, or, still others, from drinking alcohol (or smoking nicotine). And then I really mean benefit, so that there are bigger problems with not eating fat, or drinking alcohol. So it is with BMI: there are undoubtedly "islands" of constitutions that have another - higher, lower - BMI as ideal (attractor). Admittedly, the islands may be very small in comparison with islands of people who experience completely the opposite. But by measuring everyone with just one scale, we may also be able to do damage. People who fall outside the norm, but who may be perfectly healthy, are stigmatized, e.g. as anorectic or fat. They always meet with prejudice: "He may eat less (or more in case of anorectic), or she may move more". And this prejudice is, unfortunately, "scientifically" substantiated!

Now you may think that guidelines are based on evidence-based practice. But something is perfectly evidence-based if 70% of people benefit from it, and 10 to 15% are not (clearly) worse off. Remains 15 to 20%. People living on this metaphorical island are getting worse! Linear thinking is no longer necessary with our current data technology. Imagine. Most people in the Netherlands live in the Randstad (western country side). An evidence-based guideline (algorithm) to come to Overijssel (eastern province of the

country) is quickly made. But people who apply this from Groningen (northern Province) or Limburg (southern province) are disappointed. Fortunately, Navigation systems do not work evidence-based, but via current GSM signal map / theory (and therefore argument) based. Both education and health care can learn a lot from this. When I was still working in elderly care, I regularly met people over 80 who were in good spirits, literally and figuratively, but according to the current norm probably would be described with the term obesity. Application of modern data science to our argumentation, we could be able to predict - just like Navigation systems do - for each person what the individual route is to Healthy Aging!

So far we identified 3 requirements that must be met in order to evaluate technology in the context of human behaviour and cognition. Firstly, (smart) Technology must be sustainable. This applies even more if working with technology or apps requires the user's exercise and development. Secondly, technology must not block the development of the user, which can happen when radical changes are made to functions and specifications on which users have already based their development (requirement 2, see 1.1). "Convenience services" form another example that may slow down the development of the executive functions or the working memory, or the physical development (preventing play, sports and exercise in the open air). Thirdly, in developing techniques, the interpretation of the possibilities must always be part of a logical argument. Finally, the fourth requirement is that the technology must always be part of a supported social and scientific "reflective discourse". The purpose of such a dialogue is to find "a common understanding and assessment of the interpretation of belief" (Mezirow, 2000, pp. 10-11). These four requirements build on each other, the sustainability aspect, the human (brain) development aspect, the logical argument aspect and the fourth aspect, which also includes ethics. These aspects are in line with the 4 aspects from data to wisdom: (1) data, (2) information, (3) knowledge and (4) wisdom.

Putting out the fire with gasoline

(part 1)

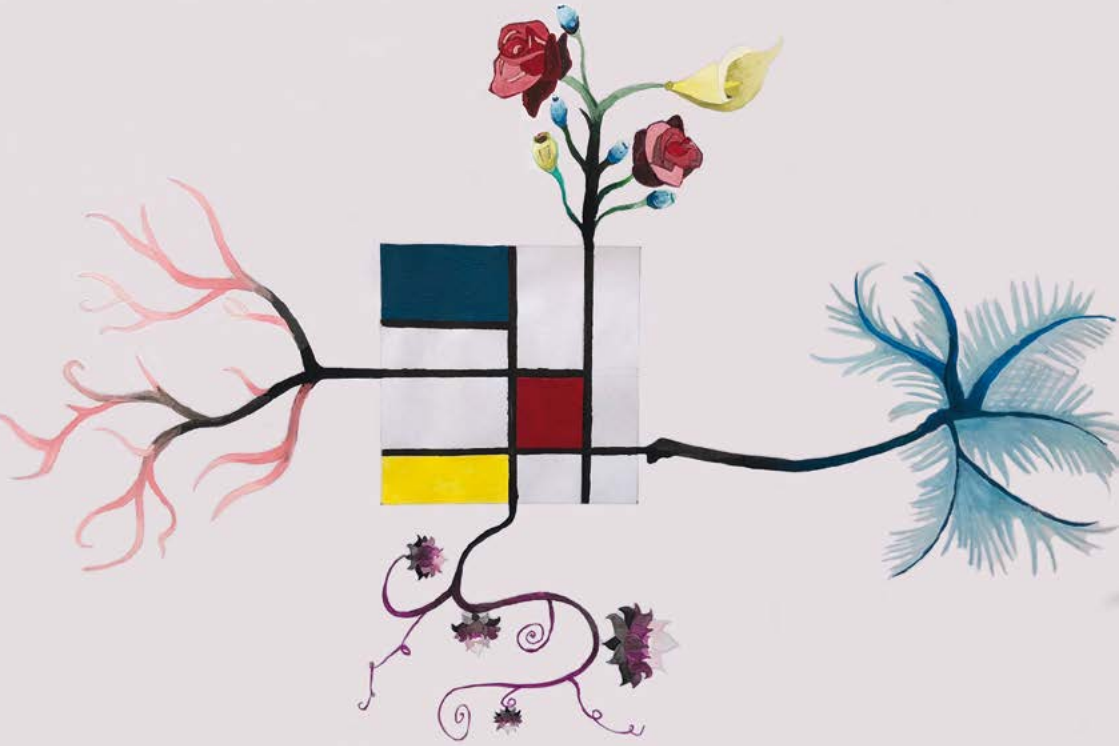
Boundlessness leads to ... even more boundlessness. Especially digital techniques have enabled us to enjoy music, literature and communication to an unlimited extent. Music, text, images, and other files can even bridge the largest distances on Earth in just a few milliseconds via the World Wild Web (and satellites). Everyone has a camera on his smartphone with a resolution that would have made Hollywood cameramen jealous only twenty years ago. In principle, digital connection would be less demanding for the planet and therefore more sustainable than traveling. Reading pages from a screen is much more sustainable than reading paper, just like music via MP3 instead of vinyl. But is that also true?

Unfortunately, the opposite is true. "We're putting out the fire with gasoline". We now travel more miles per person per year than ever before. People can now work everywhere, even at home, using digital techniques. To a certain extent, the distance between living and working has become irrelevant. But the need to meet physically just seems to have increased. Scarcity strengthens the need to meet each other. And because digital contacts are laid just as easily over two meters as between two continents, there is a need for physical contact over longer distances. The number of air passengers has more than doubled in the last 10 years. In higher education, we encourage our students to gain experience abroad.
In other words, digital technology has made the world smaller, so that the unlimited contacts that have come with it have become a new revenue model for the travel industry. A richer digital connection, for example FaceTime instead of just sound, only stimulates travel needs.
Once again, we're putting out the fire white gasoline ...

Although global awareness has increased that our long-term behaviour is untenable - even Trump seems no longer to deny climate change - we do little or nothing about it. On the contrary, politics seems to be held hostage by populism and public denial, which are expressed in short-term slogans and extremely short-term recognition/memory. For example, more money for technology development and education. Technology must provide the solution - make the world more sustainable - but more technology leads to more problems. It's like Pandora's Box: for every short-term solution of a problem, ten even bigger problems arise. Science and political parties - even the green ones - remain enthusiastic about better (technology) education and greener cities, but seem to have already given up that there is a way back. As mentioned, more money for technology education and research, so that science enables a more efficient energy transition, is the best I read in the programs. "Is this the World we created", Freddy Mercury sings more and more audibly in my head, almost 30 years after his death.

Boundless behaviour. Social scientists, psychologists, what do we do about it? In the paper I read this morning that a truck driver makes a steering error and dies in a dire situation, on the A58. Miles of traffic jam behind the accident. Dozens of people have left their car to use the camera on their Smart Phone to film how the victim is resuscitated and still dies. In Hollywood quality. The agent who spoke to the people about this was told that "he had to interfere with his own". Every form of respect has disappeared. Boundlessness is the result of unlimited availability, unlimited technology. Again the chorus: we're putting out the fire ... And our governments seem to ignore the problems for the sake of maintaining voter support and invest billions of euros a year for technological development.

A counter-movement is certainly also visible. People who moderate themselves, music on vinyl instead of MP3, vegetarianism, yoga, etc. But please politicians, do not give up. And colleagues in science, let us help with all our powers, so that there is also a world for our children and grandchildren! I don't mean helping by, for example, designing a virus in a Dan Brown / Hollywood scenario that makes at least 80% of humanity infertile, so that a "cultural forest fire" develops and the planet and drastically depleted humanity get hundreds of years "to calm down". Letting it take its course - that seems to be the current "choice" - seems to be little different from the technique stimulation that is politically widespread: the "nature" eventually also knows how to turn our boundlessness. But, can't we really do better? (continued in Chapter 3)



Odette Fremouw, *Still Life*

2. Dynamical System Approach in (brain) development

2.1 Piles of sand and in the right place at the right time!

In the context of the introduction to data science, I ask my students to imagine the differences between the actual world and the thinkable world in which every job or function would have been occupied by the best person in the world. What would be different?

"Everything", the students say. "For instance all famous names would be different. If you turned on the radio, there was music from names that we had never heard of. Probably even the grandmasters of the past, Dostoyevsky, Bach, just to name a few, would not be read or heard anywhere. And we would certainly not be listening to you as a teacher ... otherwise the world would be so different, that it is only the question whether there would be radio stations, printing, etc." I must admit, they're probably right.

Our world - like every actual reality - can be seen as a specific actualization of an infinite number of possible realities (see Bruner, 2009). Every realization (successful or unsuccessful) is based on "being in the right (or wrong) place at the right (or wrong) time". Potentially better (and also worse) realizations as a result of better (or worse) candidates, artists or professionals who are not at the right time (e.g. there is no vacancy or stage) - logically a majority - will not be heard, seen or honoured.

In my lecture it is now time to introduce calculus, the mathematics of change. Imagine an hourglass with an infinite stream of grains of sand. A "mountain" is created. Over time the mountain is so high and steep that it collapses, broadens and then goes up again. This pattern repeats and repeats, although the "shifts" - collapsing / widening and growing - require more and more inflowing grains and thus time.
The sand grains that flow in, and thus form the mountain, are all equal, but the grains of sand that "cause" the mentioned shift are seen as the Michael Jackson's, Hitler's and Dostoevsky's of the world: at the right place at the right time. Of course, people, unlike the grains of sand, can make a lot of good or bad contributions in the human world. For a data analyst, understanding of chance, probability and differential equations is essential:

$$d(y)/d(x)=f(x)$$

On the basis of a linear influx (the grains of sand), the pile of sand slowly grows continuously / linearly, until it cannot rise any higher, at which point the mountain changes discontinuously. The whole pattern repeats itself, although each cycle (oscillation) takes more time each time. A complex system emerges. A model of such system is the Lorenz-oscillator:

d(x)/d(t)=10(y-x)
d(y)/d(t)=x(par-z)-y
d(z)/d(t)=xy-8/3z

(Par, parameter, is variable)

Important is that there are linear/continuous phases and nonlinear/discontinuous phases. Freely translated, a new genre (the Beatles for example) becomes more difficult to transform into an innovation of that genre after each cycle ... I will come back to this later.

Back to my lecture. Fortunately, the students are also slightly wrong. Every person is unique. And there is something for every person, of which he or she is the best of everyone in the world! It is nice if it is something that is recognized as a performance field, or task space, for example running 100 meters, being able to sing beautifully, or painting in a realistic way. For recognized performance fields - courses - the standards (exams, diagnostic tests, etc.) are already present. But for many achievements in areas that are not yet there, or not yet recognized, this does not apply. A data analyst with machine learning and data mining cannot contribute anything, and that is also essential to know. Occasionally someone can enrich a field with new areas / realizations that perfectly match his / her special talents. Think of Alan Turing, perhaps not the best mathematician, but he brought a completely new form of mathematics (informatics / algorithm) to growth. But for everyone: you are the best in the world to look like yourself! And, all of us have been at the right time at the right place at various times. The proof: look at your own, completely unique life!

2.2 Less is more, the advantage of being illiterate: nonlinear effects

Whereas in Chapter 1 we discussed technology and focused particularly on requirements 1 and 2, this chapter deals with methodology, and mainly requirement 3 (the argument, logic) and 4 (the discourse, the social context). Our thinking is linear, from a to b. Between a and b, we automatically assume all kinds of causal connections. Coincidental affairs are difficult to understand. When someone opens a bag of liquor and at that moment a glass falls off the shelf, we tend to consider it, for example as an immediate "punishment" from a higher authority (we feel punished for our "bad" intention). Everywhere we go we see cause-effect relationships, even though we all learn at school that correlation is not the same as causation. Dynamic systems are deterministic but not always linear. During phases - so within strict limits - the systems behave linearly, but at critical moments more can mean less or the other way around: less is more. In this section we focus on some examples in more detail.

Did you ever notice? Almost without exception Elvis Presley imitators technically sing better than Elvis did. Yet they all miss the magic. Exchange Elvis for any other game changing star, thinker, writer or scientist, and the clue remains the same: technically better performers, less magic. What's up with that?

Every child enters the world illiterate. The onset of the acquisition of our first language begins when our brains start to construct invariants from an endless stream of variant sound. Your brain constructs traces based on the sounds of the voices of, among others, both mama (high voice), and daddy (low voice). Pitch height is still variant, but it also includes regularities and repeating that can be detected and thus constructed into additional invariant brain traces: "Cells that fire together wire together" (the so-called Hebbian rule). Slowly but steadily, in a bottom up manner, every child constructs the native language. However, in learning a second language at a later age (e.g. in high school or in elderly), the circumstances are completely different. You're no longer helpless laying in your crib, or box. In addition, you have built an instrument of understanding, your first language. The new language will be learned to a large extent through the first language, through some kind of top-down shortcuts. This is a disadvantage.

With new-borns their first contact with the world is on a sensorimotor basis, through tasting and touching, by bringing things to the mouth. The first words accomplish, and later replace, this sensorimotor understandings. In this way, words stand for grasps without necessarily having to grab: abstract grasping, understanding. In this sense, first language acquisition is all about the abstract understanding (grasping) of things, events and situations, very much in a bottom up manner. However, learning a second

or third language is not primarily based on bottom-up properties. Top-down aspects (already present language, knowledge of the world, etc.) prevent the bottom up emergence and therefore acquisition of the new language. Moreover, in second language acquisition there is much less synaesthesia (connection between different modalities, sound -hearing - and shape - sight - for example), both because second language acquisition depends grossly on top down processes, and because the brain has already been divided into specialities/modularity. Knowing this, it offers opportunities for education. A good language teaching method should inhibit reasoning and all the same facilitate bottom-up aspects of the first language acquisition (laying in the arms of a teacher who really loves you).

What does this have to do with Elvis? Often a first generation artist, scientist, or writer is particularly busy discovering new art, technics, or science in a bottom-up manner. They are inventing themselves, quite illiterate in terms of their to be reached achievements. The second generation is literate, using top-down shortcuts, knowing what has become successful. Often this leads to stereotypy, exaggeration, but if people aim for more than imitation - transformation - this can lead to re-developing. Then again, this second generation becomes a new first generation (bottom up) and goes on exploration: new language variation, theory, music style may be born!

Many major inventions are done simultaneously in multiple places, often independently. The big name is the one who first came to the patent office, or the artist who was in the right place at the right time. Also that is true! History - both individually and collectively - emerges, bottom up! Illiteracy means that one seeks bottom up, not yet fully injected by reason, as opposed to literacy (top down with reason). Sometimes novelty emerges easier from illiteracy than from literacy. In the second language, we have learned to trust our eyes, our reason, our literacy. We've forgotten to hear our hearts, the magic. The advantages of illiteracy have become unattainable. In any situation concerning development, it is important to make room for exploration starting from relative illiteracy. In education, more attention should be paid to this.

2.3 Lifelong learning: disrupt yourself!

As stated an advantage of illiteracy is that people are not bothered by what they already know. On the contrary, in an educated person, novelty acquisition is mainly achieved by organizing and regrouping of already present knowledge. Unless you learn a complete new skill with a considerable amount of motor components in it, learning ability is critical depending on the quality of the developed accommodations. What's up with that?

In illiteracy new knowledge and skills are mainly acquired bottom-up, for instance by exploration, imitation, trial and error. In contrast, in literacy, for example, a second language is partly learned through the (top-down) knowledge of the first language. With illiteracy I mean that there is not yet an accommodation (knowledge structure) available in which the to be learned content can be assimilated. As a consequence, in dealing (interacting) with the to be mastered learning contents, new brain cell connections (or configurations of such connections) are formed. This process is comparable with the origin of a river. Because the melt water flows from the mountain top, it eventually wears out a channel (channelling is then accommodating). The stronger this channel is already formed, the easier new melt water can be absorbed (assimilated) into it. In our brains, innumerable traces emerge. By assimilating activity in these brain traces, i.e. re-executing learned patterns, the traces become deeper and deeper. In this way, our brain is not just a river, but also a complete city that arises bit by bit.

A historic city reflects the functionality of yesteryear. The floor plan (roads, squares, canals, drainage connections, and sewerage, in short, the infrastructure) and the houses (warehouses, shops, etc.) are the result of the "learning" process of the city. The more infrastructure or accommodation there is, the less completely new functionalities can be added. A city built in the late middle Ages with narrow alleys, canals and high warehouses, cannot assimilate the necessarily requirements of a current modern megastore. For example, Middle Age houses do not have hundreds of square meters floors, and the gigantic lorries do not fit through the narrow alleyways. In other words, in the canal houses the customers will have to go up and down the stairs much more often, and the suppliers will have to load their cargo in smaller carts on the edge of the historic city. The city lacks accommodation capacity because there is already too much infrastructure. In fact, the city is literate, but in another time, in a different language.

A city, you can argue, can be broken down and rebuild. Or, and that is usually the case, a new centre can be built just outside the historic centre, on the pristine (illiterate) ground, which still can be fully adapted to the current requirements / functionalities. However, it is impossible for a human brain to clean it up, remove old brain cell connections, and start

over again. And if it were possible - to take the old brain out, and put a new brain in - it would be highly undesirable; the murder of all memories, knowledge and skills.

However, in devising education for lifelong learning, the altered/diminishing learning capacity of the older brain must be taken into account. And that's exactly my point here. Too easily we expect the elderly to build and use, as it were, a mega storehouse in a "city" that has arisen with warehouses and canals. Or with pen and pencil, instead of with tablets and smartphone. Education in the elderly must focus on finding the connection between the new requirements and the present structures. If people have built good accommodations, they can assimilate many processes, including new processes, almost without having to accommodate. But if people have formed less good accommodations, as is also often the case, they will not be able to keep up with many changes in the world (think of packing the trucks on carts on the edge of the centre). Really learning new things is possible sometimes. But one has to be relatively illiterate. For example, playing the violin if you have never played a (stringed) instrument may help, because it forces your brain to adapt again. This is exactly where the metaphor is flawed with the city; in our brain we often have lifelong land for free! In short, try to find your illiteracy, even in your old age. Even when elderly, we can sometimes be "absolute beginners"!

2.4 The easier the better?

In higher education, a transition can be observed in learning from printed copy to learning from screens. Approximately 3 decades ago, a quite comparable transition occurred from writing (pen and pencil) to typing (and computer), from manuscript to typo script. Recent research, however, suggests that our understanding (comprehension) is at stake. In an important study, Mueller and Oppenheimer (2014) showed that students who took notes with pen and paper were better at answering questions about that lecture than students who made notes on a keyboard, both immediately after the lecture, and a few weeks later. Their article was titled "The pen is mightier than the keyboard". The better understanding with pen and paper was remarkable because the written notes were full of half sentences, arrows and sometimes drawings that apparently had nothing to do with the contents. However, students who had not been present at the lecture performed much better after studying the typed instead of the written notes.

Recently, a few studies (Singer and Alexander, 2017; Alexander and Singer, 2017) showed that students learn much better from paper than from screens (E-reader, tablet, or lab top) when the length of the text exceeds one A4. Again, this turned out to be

against the expectations of the students (in advance, the "digital generation" preferred to learn from the screen). The involved effort in learning seems to be the critical factor. The main idea was grasped just as good from screen as from print (one learns quicker from the screen), but the processing of other relevant connections was much worse in learning from screens.

Does the digital world make us more superficial? We often judge things as being more valuable if we have to invest a considerable amount of effort instead of acquiring things effortlessly. Sometimes we can only see the value of things when we lose them. Many studies show that fast scrolling does have a disruptive effect on our understanding. On the other hand, a disruption of our understanding itself is sometimes extremely instructive. For example, the study by Singer and Alexander showed that for very slow readers the learning from the screen was better than learning from paper. Obviously, this sub-group of students apparently had trouble enough, even in learning from screen. They invested enough error to process the content deeply enough. For these slow readers, perhaps organizing the papers caused too much trouble. A reversed U-shape of optimal learning appears: too little effort results in superficial processing, too much trouble gives poor or no processing at all. An optimum is in the middle, at the top.

So it is not ICT itself that causes impoverished learning outcomes. Other studies (Kühn et al. 2014; Toril et al. 2016) even show that children who play a lot of games (Super Mario) develop an improvement both in executive functioning (working memory, fluid intelligence), and in eye-hand coordination. At the same time, distraction by Facebook and other social media has been shown to have a disastrous effect on concentration and executive functioning. In education, the real problem may be the quest for efficiency - making it easier for students and teachers - instead of the digital techniques themselves. Learning remains a verb, and serious effort is necessary. Too easy means too superficial. Too difficult often means that it is not done at all. But schools and universities are just like parents. From adversity we come to fruition, but in case of our children we prefer to take away all threats.

2.5 Dynamics!

No one can descend in the same river twice. There is never a way back, there is only progress. The art of living is embracing progress, even if we are burdened by the heaviness or lightness of being. Without looking back, or at least without petrifying. Petrifying happens when the present is forced to transform into the past, when the

current life-state must be a petrified copy of what once was. What is completely controlled by nostalgia is petrified. What is petrified loses the direct relationship with the process of the ever-changing reality; it "escapes" reality, even though we can never know reality, because it is process itself. In our illusion that we know reality, we're just petrifying it, and thus we're just losing bit by bit everything we thought we had ...

Sometimes this is easier thought than lived. Our brain feeds on repetition, creating patterns from perceived repetition. Patterns, the day appears when the night disappears, when the day appears, and that to infinity. The same water, the same river, the same day, the same train, or the same car. Even if the car is definitely the same, for example, it is not the same car the next moment (if it was maintenance would not be necessary). Something that is really immutable does not exist. And if it could exist, it would be completely useless. Something that does not change can all the same not change anything.
Brain constructions, though certainly changeable, stand in between an ever-changing reality and more or less petrified images of it. Hence, in the Bible story Lot's wife's fate was to fall into a salt pillar; to coincide with the fossilized past, to which she looked back: "look back in anger!"

Almost three centuries ago, the mathematician Daniël Bernoulli (1700-1782), who was born in 1700 in the city of Groningen (just one block away from where I live, in the Oude Boteringestraat), showed, that prospect (or intention) always depends on position.
If a needy person has a 50% chance of winning a large sum of money, it is attractive to sell his chance for less than 50% of the price to be paid. For a rich person, on the other hand, it is attractive to buy the opportunity:

Utility or chance:
$u(x)=C\sqrt{x}$
Expectation of utility E(u):
$E(u)=C(1-\sqrt{2}/2)$

in which C depends on the position of the "player"

Kahneman and Tversky translated this formula into a psychological rule: it is easier not to obtain something that you do not yet have, than to lose something that you already have. Give people for example an amount of money, which they have to pay off each time they do not meet an agreed goal, and they will work harder than when giving an extra reward for extra results. These mathematical / psychological principles - prospect theory - describe why people do what they do. This psychological rule belongs to the canon of a position psychology.

What does this have to do with good intentions, you might think? Following prospect theory, to people with a lot of possession, including knowledge, competence, life experience and with this past, it is tempting to avoid losses and hold on to what they got. As a consequence, petrification is lurking. "To have or to have not, is that all I've got, I see no hope in those eyes as they close", in the words of singer / artist Gavin Friday. Although both counterintuitive, and against the prospect rule, sometimes we have to throw off ballast. Sometimes we even have to kill our darlings, disrupting ourselves in order to see new opportunities, as it were, from the (illiterate) perspective of a child. Letting go is a prerequisite for lifelong learning, although exactly that is tempting prospect theory. However, while we may expect the next day, in fact expectancies and chances are components of dynamical systems.

2.6 The next day, dynamics and coincidence

A colleague told me he had walked on the Ramblas in Barcelona exactly one day before the terror attack, at exactly the same time of day. He walked down the street in the same direction, as the terrorist controlled van would drive the next day. He said: "When you walk downwards you don't look behind" and "The choice to go this day and not a day later was a coincidence."

Basically, every moment in time has an infinite number of possible sequels. Usually, however, we can tell perfectly what the next step will be, what we will do next. But in situations that turn out to have a major impact, this is often not the case, for instance in a casual affair when you meet someone who becomes your life partner, or less fortunate, when you get part of a collision (or attack) on the street with far-reaching consequences. In the run-up to this, many small random events have taken place. Events that could also have happened differently, or could have been skipped completely: whether or not to give the dog a biscuit before you get in the car, or to put the dishes in the dishwasher before leaving. Or to visit the Ramblas in Barcelona one day later.

Although usually very predictable, the outcome of (inter) action on both the individual and the group level is in principle not predictable (undetermined, or chaotic). Mathematically, this is called non-linear dynamics, or non-deterministic systems, or chaos. There are so many forces involved in the "system" as a whole and the interaction between these forces is very complex. Sometimes very small variations in the interplay of forces (e.g. whether or not the coffee cup is placed in the vascular machine) produce gigantic outcome variations (an accident, or an live-changing encounter). In other words, the future is not determined, while we live as if the future is fixed. And of course,

things usually can be guessed. Moreover, history seems determined: things happened because it could not be otherwise. But we build entire life expectancies and theories on a kind of illusionary control. To gain more insight into this, it is important to look at "surprising turns" of events.

Game of thrones is highly appreciated, among other things, because there is room for *surprising turns* of events. Accidents happen and history is full of surprising turns. Every day producers of music, films and various other new products are confronted with unexpected disappointments, or successes. Due to their extreme positions, blame and fame are more often the result of (un) favourable conditions and surprising twists, than of pure determination. As humans, we understand this badly. Thinking in *if-then-else* (see chapter 4.3) causality forms an elementary part of our cognitive constitution (psychology). Take *Thriller* from Michael Jackson, or *Wish you were here* from Pink Floyd (or any album that has reached the top). These albums do always find new fans. That is because it is history; its success is conceived as determined and inevitable. But we hardly realize that there are far more albums, some of them better, some of them worse, that disappeared in complete oblivion. History - both success and failure- emerges from a complex interplay of forces, rather than from the inherent power of the subjects (albums, stars). Again, this is cognitively very difficult to understand.

Herman van Veen sang a song "If things had gone a bit different". Then we lived in the Third Reich. Or no one had ever heard of Christianity or Islam. Or the slaves were masters and the masters were slaves. The question now is whether, for example, in psychology, or education, we should be more open to surprising turns on the scale of the individual. If a child get stuck at school, we can tell in retrospect that only a good diagnosis should have been made on time. But aren't we creating our own "evidence" from our illusion of control? Isn't it possible that a successful child becomes unhappy (or unsuccessful) due to arbitrary small changes in the chaotic interplay of forces? Otherwise, isn't it also possible that, for example, an autistic child grows spontaneously into a well-integrated citizen (see chapter 5.2)?

Anyway, I am glad my "Spanish" colleague didn't wait for the next day. Especially what does not matter to people in general, matters to us as individuals in particular. As individuals, we are not exactly identified but we are positioned! George Michael: "Turn A different corner and we never would have met!" Surprisingly we turned from Bowie (the Next day) to Michael!

2.7 Dynamic life cycles

Sometimes we forget that nothing is permanent. In our 24-hour economy everything seems to be available 24/7: energy (heat, light), entertainment (Internet, TV-radio) and food (long opening hours of shops). To a considerable degree we withdraw from the cycles of nature and the seasons. At the most, the winter vegetables are slightly more expensive in the summer, or the heating has to work a little harder in the winter night, but the climate and nature have been reduced to mood setters in the background.

Technology plays a crucial role in the realization and organization of this continuously available reality around us; (ICT) technology and services contribute to the illusion that we humans are just as continuous as the artificial - denaturalized - world around us. This makes it easy to forget that our psychological and biological reality is completely cyclical, just like nature and the climates. A simple way to observe 'natural' fluctuations is to look at our relationships with friends, loved ones and our work. Our willingness to invest in relationships depends on a large number of factors, but these factors are different for each phase. In the initial phase of, for example, a working relationship - the growth phase - often a lot of investment is required to adapt to the new job demands. It is important that the perceived compensation is well attuned to the investment delivered. Psychologically, these processes are not always linear. For example, it has been proven that a large investment with a not abundant but adequate compensation is preferable to a generous fee with a lower investment. The theory of cognitive dissonance plays a role in this. Because we want to keep the image of ourselves consistently, someone who invests a lot and receives relatively little in return, is inclined to take the investment for his own (internal) account (motivation). After all, we do not like to see ourselves as losers who work so hard for nothing; we work hard because it's important!

After the first *growth phase* in a new (work) relationship, we enter a phase of more stability. In this second *stability phase* we can also concentrate on other issues than the new relationship, although we can't fully rely on our automatisms until the third phase, the *routine phase*. But of course, things change continuously both at work and in relationships (a new boss or colleague or new procedures). Although it is relatively easy to adapt to changes in the stability phase, this is more difficult in the routine phase. Automatic patterns become difficult to break. If it's really necessary to break the patterns, we may enter a fourth phase, the phase of renewed choice. In this phase everything is upside down. Break, burnout or further growth to another job, relationship or level, is more prominent within this phase than in the other three phases. After such a "choice", the cycle repeats: growth, stabilization, routine and choice. During our lives we go through many of these cycles. It is no coincidence that, now that our world is so constantly available, on average we start with jobs, friends and loved ones over and

over again. Now that we derive our stability from a continuously available environment, our cyclical nature is fully reflected in our relationships and our jobs (serial monogamy, hopping jobs). Although I believe that our psychological well-being would benefit from maintaining a more reciprocal relationship with our sources and nature (and that would certainly benefit the environment), it is important to recognize these phases in relationships and at work.

Most HRM tools presuppose continuity of the employee, for example by emphasizing personality. Together with colleagues from the Hanze University of Applied Sciences and software house BizzXL and ADenzo my team builds a tool that specifically highlights the different phases for the individual employee and thus helps the employee to orientate himself on his own dynamic life cycle (APK Werkscan). We use data mining algorithms and we try to contribute to emphasizing that everyone is always changing: Nothing lasts forever!

Box 3:

Affordance structure

Architecture, the design of our homes, districts and cities, is vital for how we feel, think and behave. For example, it is decisive whether people are "locked up" in buildings where only the number on the front door refers to identity, or that a building or city is designed to facilitate activity, encounters and solidarity. The scale of a neighbourhood can be based on car mobility, or on walking opportunities, which makes a world of difference. A street in which people live is very different from a road that is only passed by. If a car is needed to reach anything, this may emphasize the feeling of being trapped (people who are housed in this way often have limited money for transport, with all the consequences). If, on the other hand, there are plenty of opportunities to go to theatres, schools and shops, the meeting will be facilitated. Smart Technology does not help here: being locked up in a grey apartment (urban sprawl) generates at best a desire for the apparent utopias of media such as Facebook and with that even more depressive feelings. A building can make a difference. For example it can prevent nursing home residents with dementia from wandering like polar bears in captivity, to just seek and find the encounter. In order to seriously understand the potential impact of architecture, it makes sense to see how we are housed in our own body, how we live organically in our bodies.

The scale of a neighbourhood can be based on car mobility, or on walking opportunities, which makes a world of difference.

Odette Fremouw, Human3

3. Position versus pre-disposition

In Chapter 1 we discussed the possibilities of smart technology as an extension of human behaviour and both the potential opportunities and limitations. We identified 4 requirements through which the interactions between people and smart technology can be evaluated. In Chapter 2 we stressed the importance of dynamics in development; developmental outcomes are both not predetermined, and not always linear (no fixed way from a to better). In this third chapter we focus on the relationship between brain (biology) and technology (culture). Homo Sapiens have been a cultural and therefore technical species from the beginning. Culture/technology has, to a certain extent, set people free of biological limitations. Yet, "brain scientists" often point at the idea that our brain determines our behavior. What's up with that?

3.1 Bio-determinism

Since time immemorial, adults are responsible for their own behaviour. Both our own judgments, and our legal system are based on this. For example, it brings us into turmoil if someone violates the traffic rules. However, neuropsychological research shows that people often base their decisions on other aspects than they think they do. For example, soccer goalkeepers decide in which direction they will dive on the basis of information from the penalty taker's gaze and movement behaviour (position of the non-kicking leg and viewing direction). However, they're convinced that they base their dive on continuously monitoring the ball, which is impossible; the time to process the image of the ball and base the motor output on that, is simply is too short (Savelsbergh, 2002).

Bio-determinists argue that human freedom is strongly determined by biological structures, especially the brain. Popular scientific titles go to show: "We are our brain", "Free will does not exist" (Swaab, 2011; Lamme, 2011). If a traffic fader is overtaking on the wrong side of the motorway, activity in the caudate nucleus preludes the moment we feel angry. However, the fact that we do not always know on which aspects we base our choices, does not mean that we have no will to choose at all. A keeper can also do nothing, or always dive in the same direction, etc. In fact, this is not an argument that there is no free will. Bio-deterministic reasoning is not only naive, but also certainly potentially dangerous. Why?

It tempts to "uplift" someone who shows deviant behaviour from second to third person (someone we can talk about instead of with). In fact, this is what "classical" psychiatry has been doing for a long time. Of course some people are not accountable, for example due to severe intellectual disability. Even children are not yet fully responsible for their actions. But if someone is sad for a long time and doesn't want to live, a

psychiatrist will come up with a "cause" (diagnosis depression, for example), making the doctor responsible for the condition/treatment, and all thinkable consequences (even euthanasia, if the treatment doesn't work). This way of thinking - deviant emotion or behaviour is an indication of a disease which can be treated - can be applied to any thinkable disorder. But - even more dangerous - also to any religious, political, and artistic expression or belief that we do not understand. It must be in the brain!
Many futurologists present the future as an unequivocal road in one direction: towards a technological salvation in which man is supported and relieved as much as possible by smart technology. Salvation shines on the horizon, like the gold at the end of the rainbow. But technology both dictates and globalizes, making people more alike (see chapter 1). Anyone looking for a different way is at risk of becoming a third person, someone who isn't talked with but talked about. Biological determinism rears its head: something in the brain must be responsible.

Why are some facts told so little? We are not on the way to a technological sanctuary. To be human, people do not necessarily need smart technology. Development is not unambiguous from bad to better. Afterwards, many "good" solutions turn out to have substantial dark sides, which of course were not visible in advance. People have a free will. Therefore we're responsible for our own actions and choices. Exceptions are very rare. Again, although we choose on the basis of other things than we think, it remains our choices. Imagine letting go of the principle of our own responsibility, which underlies our legal system. We would certainly end up in a horrendous dystopia.

Our brain is important. A car does not drive without a motor, but the purpose of the journey is not anchored in the engine. As long as we are judged on what we do or don't do in the world, running away on time in a conflict, for example, we are not our brain. Whether we like it or not, we are bound or even condemned to our free will. We are the essence of our own lives, and cannot outsource that, neither to technology, nor to bio determinists.

3.2 Pre-disposition or Position?

If all our characteristics were fixed, psychology, educational theory, and pedagogy would be superfluous. At best they would play a modest supporting role to indicate under which circumstances the innate characteristics come to growth the fastest. Nor would there be cultural development and, on closer inspection, any progress. It is hard to understand why the human and social sciences are undermining their right to exist, e.g. by assuming innate intelligence (the IQ), various labelled alterations from normality (abnormalities like autism, dyslexia, etc.) and, last but not least, a periodic system of personality (Big 5: 1 Extraversion, 2 Kindness, 3 Openness, 4 Accuracy and 5 Emotional Stability). By assuming this, these sciences leave aside that the continuously changing person is positioned in an ever-changing world. What's up with that?

More and more recruiters are using big-data analysis (machine-learning) based computer tools to determine in advance whether someone fits well with the job, or the company. Whether the pre-disposition of the candidate will bring the organization to progress, standstill, or decline. As if the candidate is a material, say wood, a polymer, or a metal, of which you can calculate how well it can carry the wearing floor in a planned parking garage.

Practically all progress is based on discontinuity, for example on a person or a group of persons who do not fit with the current system. Learning algorithms look for patterns in the available data, retrospectively. Prediction is based on the continuous extrapolation of such patterns to the future (see chapter 1). But if a company has saturated the market with its product or service, or has solved a problem, it will have to make a change, discontinuously. Remember that the best candidates to make a change have been set aside by the trendy recruitment tools! Especially people who think differently play a major role in progress. In all times, everywhere, from science to art, from local to global. A rather random selection of famous examples: Newton, Beethoven, Einstein, Marie Curie, Turing, Beatles, Madonna, Jobs and Musk.

In addition, although very reliable (see box 4), people are not constant. It is perfectly conceivable that someone is successful in an organization at moment A, but not at time B, or vice versa. People change; their circumstances make them have more or less energy, or motivation. Organizations do also change. Every human being, and every organization does repeatedly experience the (oblique) S-curve of growth, stabilization, routine and choice/break, see 2.7. In the growth phase, working somewhere new, or having started new activities, adaptation to changing demands or the relationship comes easily. However, the opposite is true during the routine phase, regardless of any assumed or supposed predisposition. No, we are not elements with fixed physical properties. Someone can be super extrovert on stage and shy away from the stage

(e.g. David Bowie, Freddy Mercury), or vulnerable and insecure (Lady Gaga). And on closer inspection, even the elements are only relatively constant ...

There is only one answer to question whether man is mainly the result of predisposition or of position. With the colleagues of the Hanze University of Applied Sciences, my team and I are building a digital instrument based on the answer position. We help the employee to look at his or her position in the cycle. Without big-5 or any other predisposition labels, we develop a big-data and machine learning instrument to facilitate reflection. Nothing more, nothing less. Because adapting is still what human are good at, just like thinking outside the box. We are not really trendy, "against all odds" and I am proud of that. But I still hope that psychology stops positioning itself offside by becoming a process (position) science. The emergence of applied psychology is partly due to people finding the traditional psychological science too academic. Again, not fitting into the system can stand at the beginning of progress!

Box 4:

Reliable!

We may not say it often enough to each other and to ourselves: in general we are extremely reliable! Race, colour, religion, gender, sexual orientation, political preference, it does not matter: people are incredibly reliable! Our reliability can prove to be our lifeline, because humanity faces major challenges, for which togetherness, loyalty and reliability are even more important than ever before. The Intergovernmental Panel on Climate Change (IPCC) 2018 report, which maps the global warming, for example, shows that the (negative) effects of global warming mainly affect vulnerable people in poor countries, and the weak in rich countries. If we don't begin to behave differently all together, then our culture and technological inventiveness will bring us to decline.

Back to reliability. Imagine, you live in Groningen (the Netherlands), and made an appointment to meet with an uncle the day after tomorrow in Wanaka, a small town in New Zealand, at 17:00 in the afternoon. You dine together, talk all night long and then stay the next day to travel to Albert Town to visit other family members. However unlikely it is, the chance that you will meet each other at the agreed time is very high. Countless people have to act as reliable "partners" in dozens of parts of all your plans and activities. Pilots and stewardesses, but also waiters, maintenance engineers, fellow road users, fellow passengers etc. Everyone who adheres to the countless (written and unwritten) rules and regulations is reliable. On the other hand, you only have to "meet" one unreliable person, for example a ghost driver on the wrong side of the road, and the whole plan falls apart with your entire future. However, that is very unlikely to happen. Again, we can actually trust each other blindly, and that may well be said.

Of course we are all occasionally deceived. Occasionally - often unintentionally - we also deceive, often a loved one, usually ourselves. And of course it is the "dissonant" - the things that go deceitfully, that can always count on our attention. Television series, books and newspapers are full of it, precisely because dissonants form invariants in our almost endless (variable) reliability. But "reliable" is not necessarily "wise", or "correct". Unfortunately, we can reliably move completely in the wrong direction and perish. History is full of examples of an almost "machined" lack of argument, insight and wisdom. For example, in view of the warming of the planet, this becomes painfully clear. More than ever before, we need our reliability to really secure the future. Flying, for instance, may not be sustainable in the long term, certainly not on the current scale. Fortunately, instead of the day after tomorrow, we can still visit our uncle in New Zealand in a plane-less future; just as reliable by boat, it only takes a few weeks longer!

3.3 Stages over and over again, all through our lifespan

As we saw in 2.2, our brain is fed by repetition: cells that fire together wire together. However, nothing in our world ever repeats; reality is a continuous flow with an infinite variance. But every time it gets dark again, for example, our reactive (firing) brain cells utilize the repetition by patterning the cells into a brain trace, a knowledge construct. The more frequent events happen in a "same like manner" (invariant) in the outer world, the deeper the corresponding emerging brain traces will be. Repetition is a brain "construction", emerging from brain activity and not an inherent aspect of reality; patterns (and patterns of patterns etc.) are brain constructions ("truth is in the eye of the beholder").

Usually, an experienced brain only needs fragments of the invariants in the outer world, to automatically use the invariants and thus interpret events (just like Sherlock Holmes)! This happens automatically, because in the infinitely variable world, our brain sets aside central attention as quickly as possible. It pays no or very little attention to the expected events, so that it can reserve the relatively "expensive" central attention for the unexpected, which is always lurking. In other words, the "cracked" patterns are processed automatically as much as possible. Automatic processing goes quickly against low costs of energy. However, automation is not prepared for completely new situations.

Most of the time our life goes automatically! That's not necessarily a problem, except when stability has turned into routine (stagnation) while we have to adapt to new demands. If both our automated life no longer satisfies the requirements / environment, and we do not succeed to adapt, this may result in trouble, for instance a burn- or bore out! Fortunately, our cognitive system has a kind of inborn answer to this: radicalization, an energy booster, e.g. falling in love.

During our lives there are several more or less typical phase-bound moments (stages) in which we no longer fully fit into our hitherto automated life, e.g. in puberty, if we have to continue on our own feet, in our thirties, as after a number of years we feel that we are being sucked into a rut by family and work, in the midlife crisis, in illness, or after the loss of a life partner. At these moments a booster is sometimes necessary; being in love helps our brain, as it were, to reset our cognitive-emotional system. In this process, our whole thinking, feeling and being is narrowed / radicalized. The temporary turbo modes may give us wings, as it were, to break out of the unsatisfactory situation. Romantic love - radicalization - the outbreak of energy.

During the infatuation everything seems different, more intense. We feel like we can move mountains, even though we know that we would not be able to continue for years

without changing into wrecks. But leaving the safe nest (parents, or later family and children), or starting over again with your new love and leaving everything behind is no small feat: the new love is everything, and everything else has to give way. Love is radical and sometimes occurs in an important event in life, for example after the death of a life partner. In the case of overwhelming fear or sadness, suddenly that spark is present. The pink glasses, a radically new perspective, a way out of a situation that is no longer liveable.

It is beautiful and frightening at the same time. Sometimes the judicious ability is temporarily under pressure. Sometimes it turns a depression off, it gives hope again. Sometimes people plunge straight into an abyss, if, for example, families and hearts are broken. It is sometimes psychiatric. Romantic love - psychological extremism - can also focus on material matters such as houses, cars and property, or on religion, or worse, struggle and violence. If someone radicalizes religiously, the question is what makes the booster apparently necessary.

3.4 Body and soul

Some months ago, I accidentally took the IPad from Dorinthe, my 9-year-old daughter. Not only the colour (white, mine is black) is different, it is as if I have a totally different device that I cannot do anything with. After a long search, I found the note app between the Pony and Barbie apps on which I write my weekly column for the British journal Education Journal. Apart from the colour the hardware is the same while the devices have completely different software. What about people, hardware (biology) and software (culture)?

Of course we are and remain biological organisms. But since we invented the spear we do not necessarily have to evolve large tusks or thicker skin, since we started controlling the fire, or wings since we have planes. Culture complements us, makes us partly independent of our biological "shortcomings" (and thus evolution). This is clearly visible in the fact that the genetic distribution of the entire modern humanity is smaller than that of the dogs present in a random park, or a group of 25 living chimpanzees, to stay genetically slightly closer to home. What's up with that?

Our construction starts with an egg cell and a sperm cell that is 83,000 times smaller (in this phase the female is certainly cooperative). The 2 cells double, and double, 47 times (2^{47}) resulting in the 140.737 billion ($1.4 * 10^{14}$) complex collaborating cells! Every day millions of cells die and the same number is re-formed. Usually we notice

nothing of this "maintenance" (sometimes a cold, sometimes worse). In time, for example, we get hungry, we eat and then we become saturated, or there is a sense of movement. All essential nutrients and processes are thus guaranteed. Our body never gets older than 10 years! Every 10 years all cells are replaced at least once (most cells many times more), except for the nervous system, but in the nerve cells everything is replaced repeatedly. In other words, only the cellular structure of the brain is still about the same after 10 years: the façades and roofs remain, but all interiors and inhabitants are new. Everything - organs, skin, limbs etc. - is continuously rebuilt according to the DNA "prescription". Admittedly, there are mistakes in the process, last weekend I saw a picture of myself from 35 years ago. As a "resident of my body" I wished to have more influence! Precisely because after 10 years, no molecule in our body is the same, it is baffling that we experience continuity and have flawless access to memory, knowledge and competences of a much longer time ago. That means that we exist in connection, not in content! The "building" that comes up again and again has an intuitive feel (persuasive technology) that surpasses all man-made technology (even the ball). Where our top-down understanding and control occurs on the scale of culture and development, our bodies emerge over and over again in a bottom-up process, through self-organization and evolution.

Everyone has 2 ancestors. A generation further - the grandfathers and grandmothers - are 4 (2^2). 10 generations further on 2^{10} (1024). We count 25 years for a generation. So 1000 years back gives 40 generations and 2^{40} ancestors. From the beginning of our era, everyone has 2^40 ancestors (1.2 million times a billion times a billion): you and I each have more ancestors than there ever lived people! With the 107 billion people who have lived so far, we come back "only" 37 (36,64) generations, until the year 1101 (in 1101 Limburg became a duchy):

$2017-25(2\log 107.000.000.000)=1101$

This makes it clear that we simply share an enormous amount of ancestors, very often. At most, between the 1 / 1000th and 1 / 10,000th of our DNA is different, that is our biological individuality. Add to that the fact that the modern man only recently existed (300,000 years, the 200,000 from the books was adjusted a few months ago on the basis of a very recent discovery) and that mankind had almost completely disappeared some tens of thousands of years ago (estimates that there are between 2,500 and 10,000 people), and it becomes clear that we genetically practically all "live" in the same body.

So which man "reproduces" with which man (black, white, yellow, large, small, thick, thin etc.), biologically speaking, it is at most slightly less inbred ... A number of

consequences are important for the human sciences: (1) search the biological components of individual / social / cultural differences may be less sensible in many contexts than it seems; (2) there is a ground of existence for social sciences; (3) From a biological point of view, racial discrimination is rather absurd, it is cultural discrimination! Here is our strength and weakness: biologically colour differences reflect just the superficial exterior. Inside we're one, culture has put our biology aside. Culture, although not always visible, is deep. Despite the fact that during a lifetime we went back many times at the cellular level of complete renewal, we experience consistency and identity. The IPad exchange makes this economy very beautiful: the device is the same, the culture on it makes the difference between me and my daughter! Endearing, Apple makes it look like a device, but the distance between the IPad 2 of my daughter and my IPad air is much greater than between a Great Dane and a dachshund!

Box 5:

Nature-nurture: Genius in variety

In the newspaper I read about prodigies. A three year-old rock drumming toddler. An eight year-old boy doing complicated calculations, and a 20-year-old girl who has already achieved a PhD in theoretical physics. In my life, I have experienced such a "prodigy" in real life once. Peter was a six year old boy. Completely out of the blue, it seemed, he started playing the classical masters on the piano. Two handed, on a very simple third-party keyboard, because his parents (my acquaintances) had no interest in music at all. Peter's performance was without education or any form of teaching at all. Where do these talents come from? It seems completely underdetermined by learning and experience. On a closer look, however, Noam Chomsky already showed in the 1960s that skills such as language acquisition and logic are never determined by learning and experience. And that does not only apply to prodigies; in only a few years (practically) all children learn their native language on the basis of poor data (spoken language) consisting of incomplete sentences full of errors. Yet every child distils "effortlessly" the correct rules from the imperfect language utterances (many half sentences, incongruous conjugations, etc.); when children are still young they already can judge whether a sentence or conjugation is correct or not (at age 7 or 8 they can give a so-called well-formed judgment).

Even more amazing than the prodigies, is the fact that many science and game changing persons showed a delayed instead of an accelerated development in their early childhood. For example, it is known that Alessandro Volta, the inventor of the battery in 1800, developed late, unable to speak properly until he was seven. (His parents thought he was mentally retarded). Wilhelm Röntgen also visited so-called 'extraordinary' primary education (a school for children with learning difficulties in the Netherlands, in Apeldoorn, a city where our university has a faculty). There are numerous other famous examples of delayed development in geniuses: not only Albert Einstein, but also the CV's of many contemporary professors make their way through lower craft schools before developing their scientific careers.

In short, frontier scientists and artists - geniuses - develop in a large variety of ways in their childhood, from prodigies (e.g. Jean Piaget) to ordinary students, from good students to slow and even very slow pupils. This is both fascinating, and incomprehensible from didactical, pedagogical and psychological frameworks. We are all acquainted with physical differences between people and pros and cons thereof in diverse contexts. Small, fast and viable, for example, is opposite to large, slow and powerful. One type is not better than the other, every "construction" is sometimes an advantage, sometimes a disadvantage. But do we have only one type in the case of idea cognitive development?

We need to make sure that, by means of more automation/standardization; we do not promote only one type of development.

At school, there is especially focus on good = fast performers. Well, of course, there is remedial teaching for slow developers, but we rarely realize that some slow developers will eventually develop to be geniuses. Already in primary school, didactics is strongly related to average development (normal distribution). However, from data mining it results that even the child's month of birth coincides with the rates of success at school and consequently at careers: young students (born in May or June) have a greater chance to walk behind older students (born in November or December). Some children, however, develop atypically, in a different order.

It would be nice if we could distinguish various types of developers. By using modern data analysis techniques (machine learning), several more or less typical patterns of development can be distinguished. For example, some children may explore for a long time in one phase and then continue to the next, while other children seem to take a leap at a young age. Pattern detectors are able to discover many other (still unknown) patterns. But unfortunately, reality is exactly the opposite: ICT applications narrow

the scope, rather than helping teachers to look more specifically to each child. The now dominant methods of determining the levels of school readiness and achievements, with standardized testing already for 4 years old children, is certainly not without risks. We need to make sure that, by means of more automation/standardization; we do not promote only one type of development. Application of technology - modern data analysis - allows for personalized didactics. Making visible differentiation (diversity), instead of favouring indifference. But bad or insufficient applications (being innovative, use as much ICT in education, or other silly likewise arguments) bring about the opposite: indifference!

Chapter 3 examined the flexibility of the psychobiological system (the brain component). It was stated that man is, as it were, "devised" to deal with a great many different technologies and cultures without needing biological (genetic) adjustments. So man is predetermined to create and to adapt to culture. Because of this, a process perspective is preferred over a predisposition perspective. Human offers a lot of space for nurturing and education. A "hardware system" - our human bodies and souls - are available on which many different "software systems" can be developed and played (more on this in 5.2). Cultural adaptations (technology) made it relatively unimportant that the genome of humanity is rather narrow. For 200,000 years, culture and technology have served as a sort of shield that protects people from both biological changes and human evolution. This results in a controversy: while technology and culture have lessened the need for evolution, the impact of technology on people is smaller than would be expected due to the narrow genetic basis. Again, a dynamical system! As a consequence, requirement 1 (sustainability) and also 2 (development may not be blocked by technology) become relatively subordinate to 3 (argument) and 4 (discourse). In chapter 4 the human reasoning capacity is further investigated. However, psychology often starts from assumptions of predetermined features, like intelligence, personality traits, and etcetera. The question whether man is mainly the result of predisposition or of position, can be answered: people exist in connection, not in content! Adapting is what human are good at! Since time immemorial, cultural change and adaptation process - *process* - has overwhelmed biodiversity - *predetermination* - by far. Applied psychology must position itself as a process (position) science: psychological adaptation is at the heart of technological development!

Putting out the fire with gasoline

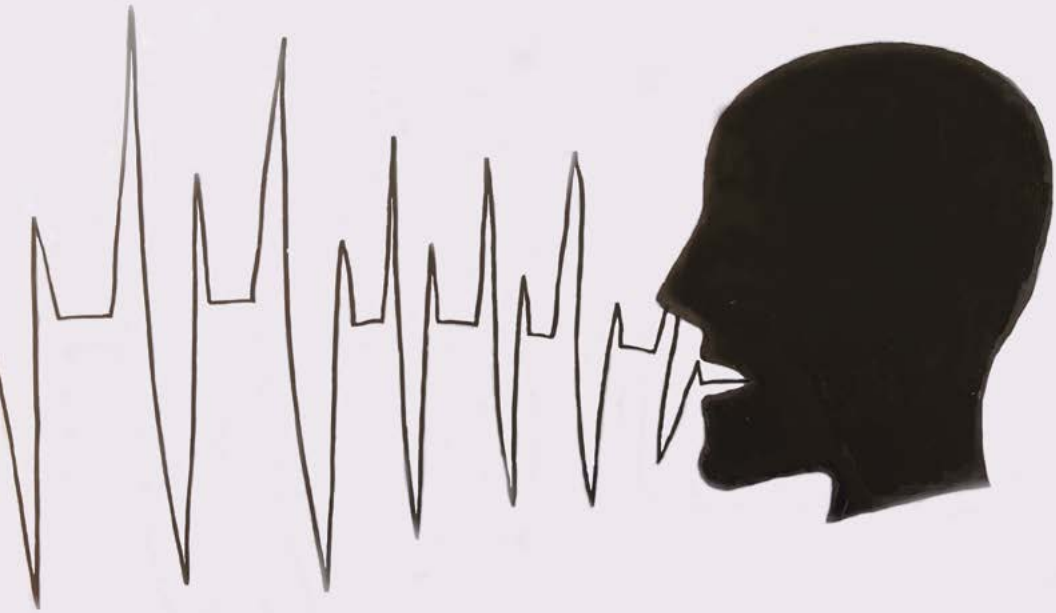
(part 2)

In the 70s, when I was a teenager, pop music was extremely popular. One of the biggest attractions was the myth that was spread over hit bands and pop stars. Because 'serious' journalism hardly played a role - there were a few tabloid magazines and there was no internet - the stories were collective myths to which we all contributed. This was often even more important than the music itself. In other words, our youthful imagination was limitless and in my generation that led regularly to the founding of our own bands or to other (artistic) activities. We loved our dreams, and the bands that fed these dreams. One of those bands was Queen.

A few weeks ago, a day after the premiere, my wife and I decided to go to the film Bohemian Rhapsody. Of course we had read the rather negative reviews in our "quality" newspapers. However, despite an age difference of more than ten years between my wife and me, our admiration for Queen stands for a bond that had greatly fuelled our youthful imagination. We were very early at the cinema and the film would play in the biggest room but almost all tickets were already sold out. An hour later, when we sat in our chairs it became clear that the cinema hall filled up with an audience literally from teens to 80 years old. Like snow in the sun, all negative reviews disappeared from our minds when the movie started: the film was compelling and fantastic! For a moment we were the children we once were, with our own dreams and imagination. When the film was over, everyone stood and applauded (something I seldom experience in the cinema). Now, a few weeks later, I read that there is still applause everywhere in the country and in the Netherlands alone, the Facebook page of Pathé is full of praise (many thousands). What a bad movie?

Something special is going on here: the first journalistic reaction to the film itself is fake news. The "real" news is that a film has been made that appeals and moves several generations. Like many other films, the film is freely based on a true story. It is not a documentary, but top entertainment. Yet this issue made me think. Nowadays the "facts" and thus the "truth" seems inescapable: there are cameras everywhere and every movement, statement or (public) performance of a "celebrity" is filmed and posted somewhere. Therefore there's hardly any room for imagination, let alone for myths. The problem lies in confusing facts with truth. Newton, for example, would never have come to his deep knowledge if he had not looked past the facts, like many earlier great minds (Aristotle and many others). There are never enough facts, if you look better there are always other facts. Modern information and communication technology (ICT) has made the world seemingly transparent, and that's why especially in this time "fake news" has become such a big theme.

The reason is that we are all people, including journalists and reviewers. People are narrative creatures, we all have our myths and through myths we are connected to each other (religion is from "religare", Latin for binding, connecting). It's an illusion that facts can replace stories, although facts always have a place in information and knowledge/stories. It's an hierarchy: data (facts), information, knowledge, wisdom. At the level of knowledge and even more at the level of wisdom, facts no longer play a direct role. And despite cameras on every street corner, eavesdropping devices and smart search algorithms that analyse the many digital crumbs that we leave behind on the internet, there are always many more facts that remain invisible. The risk of ICT technology is that it kills the imagination, that it creates a false reality of facts. People need stories, they respond from knowledge, not from data, which, as mentioned, is always limited. The hunger for more and more sensors, cameras and data to understand something of our world is again a form of .... Putting out the fire with gasoline! Our hunger for knowledge is being satisfied by the elimination of our imagination, resulting in an even greater need for knowledge. That our collective stories can also be wrong, show the reviews in the "quality papers" with regard to Bohemian Rhapsody, right? After the premiere "Het Parool" headed: "worthless". It's now a fact that few people share these prior opinions of reviewers: the film attracts a record number of visitors in the Netherlands alone. The reviews seem to have been fake news themselves!
(continued in Chapter 5)



Odette Fremouw, sound

4. Psychology and argumentation: about the logics and ethics of psychology

In the previous chapters it became clear that - in relation to psychological processes - the value of technology (and culture) can only be evaluated/determined in a (reflective) discourse. Data must be converted into information, which is only possible within a knowledge structure, which will be tested in the long term on the basis of its inherent wisdom. In other words, evidence only becomes meaningful if it becomes known within an argument. In this chapter we will discuss (psychological) argumentation as the main components of the discourse.

4.1 A valid argument is more than just an opinion!

So for many decades social sciences have been captivated by the statistical method. In itself there's nothing wrong with this. However, there's a serious side effect of a strong dependency on surveys, Likert-scales and normal distributions: the argument is mainly seen as opinion and therefore hardly scientific. However, the science from which the statistical (quantitative) method is derived - mathematics - is based entirely on the argument. What's going on?

An example. Psychology professor Angela Duckworth conducts research into talent and examines the hypothesis that everyone within normal physical, cognitive and neurological boundaries is capable of becoming a high achiever. She states that the "grit" factor (motivation and lots of practice) always determines talent. The professor verified her hypothesis by interviewing a considerable number of top talents. It appears that they have all practiced a lot, especially under initial external motivation. *If x, then y*. Even Mozart "fits" in the scheme: before his father showed the prodigy to the world, he had had dozens of hours of practice. The statistical analyses have been carried out error-free, and for good reason the results have been placed in highly rated journals.

Arguing can always be traced back to four derivations, two correct ones, and two incorrect ones. The derivation used in the talent study is the modus ponens: x, then y, (verification). But x, then y does not automatically mean y, then x: If we see an exceptionally skilled person, he will have practiced a lot. After all, it is also possible that the skill has emerged without considerable effort, that it is in the genes, or that someone has been genetically manipulated, or came from another planet. This incorrect derivation is called "affirming the consequence". This fallacy is often implicitly present in statistical research. Sometimes in their discussion section scientists mention that correlation and causation aren't the same: an alternative explanation for y cannot be excluded.

A modus ponens can be verified: an extreme skill level always follows a lot of practice. A correct derivation that often remains out of sight in the statistical method is the modus tollens: x -> y; there is no y, so no x. Finding a very ambitious parent/teacher who is training a "normal" child unsuccessfully but methodically well on the piano, falsifies this hypothesis. A high skill level without much practice also falsifies this theory. This isn't an opinion; it's a logical fact! In demonstrating exceptional skills on YouTube at a very high level of achievement, (idiot) savants and prodigies, falsify Duckworth's theory. Their skills (y) do not stem from exercising and motivation (x). Two fallacies are made; x -> y is equal to y -> x (affirming the consequence) and the ignorance of the modus tollens. No matter how hard we try, we cannot teach a mouse to roar, just as we cannot convert a tiger to vegetarianism! But because of the low status of the non-statistical method, social scientists produce journals full of well-executed quantitative research in which arguments and more probable alternative hypotheses are often wrongly dismissed as "opinions".

The Wason task illustrates specific shortages in human argumentation. Subjects receive 4 cards: "A", "4", "C" and "5". The rule is: if there's a vowel on one side of the card, there's an even number on the other side. Question: Which card (s) should you turn anyway in order to check the rule? Card "A" must be reversed. Almost everyone succeeds (ponens mode). Card "4" (x, then y isn't equal to y, then x) isn't about the rule. More than half of people turn this card around (error "affirming the consequence"). Also card "C" doesn't need to be reversed (error "denying the antecedent"). The card with number 5 must be reversed! Only 5% of people succeed! It concerns the modus tollens: no y (even number), so no x (vowel). If there's a vowel on the back of the 5, the rule is falsified. Both wrongly "affirming the consequence", and not applying the modus tollens are erroneous present in the talent study. A good argument is not just an opinion.

Box 6:

Famous logical fallacies

(1) Evolution is selection of random mutation in function of adaptability. (2) Operant conditioning is selection of behaviour in function of reward and punishment. Both mechanisms (Darwinian and behaviouristic) are examples of conditional algorithms and - therefor - linear systems. Both mechanisms are insufficient in explaining novelty, as was showed by Chomsky in Behaviourism and by Kauffmann in Darwinism.

From single-cell organisms to complex mammals, there has been a huge increase in complexity (negative entropy)

Argument: From single-cell organisms to complex mammals, there has been a huge increase in complexity (negative entropy). By its definition a conditional algorithm is a selection mechanism, and cannot explain this increase. From illiterate to literate is a huge increase in complexity, in which a child never makes certain mistakes that are logically the most obvious (Chomsky, 1980). Behaviourism (on the scale of ontogenesis) and evolution (on the scale of phylogeny) do at most play a modest supporting role. Self-organization and dynamics play a major role (Kauffman, 1993).

4.2 Daydreams are yellow, about the creative power of psychological research...

Probably the most common method for obtaining information through psychological research is to postulate a position and then ask the respondent to indicate to what extent they agree or disagree. For example, the respondent will receive 5 options: (1) completely disagree, (2) disagree, (3) do not disagree / agree, (4) agree and (5) completely agree. Both for individual diagnostics and for large-scale surveys, this so-called *Likert scale* method is often used, with answer possibilities (the scale) varying between 3 and 7 "points". For example, individual diagnostics involves questions such as "How often do you have thoughts about death" (almost *continuously, regularly occasionally, rarely, never*) or statements like "I find it difficult to give my opinion when asked in a group where I still do not know anyone". Questions are then clustered by subject (e.g. in a cluster of suicidal thoughts, or social anxiety). If there are a number of questions per cluster, one can compute the internal consistency reliability. After all, it

is unlikely that someone who often worries and thinks of death indicates in a different question to be seen at home as a ray of sunshine.

With surveys, the opinion of the average Dutch person, or the average visitor of a company (e.g. a catering company) can be determined. This is very frequently applied. With (favourable) outcomes, the results are proudly added to the ads ("customer satisfaction is very high", or "we score 4.3 on average on a 5 point"). There is, however, a lot wrong with this for several reasons.

In this way social desirability often plays a role. If you have just checked out and the friendly receptionist asks you to fill in the short evaluation, you are inclined to evaluate the hotel experience differently than if you look back on it from a distance later on. There are also more mathematical objections to, for example, the conversion of nominal scale values into (interval scale) numbers. For example, is the distance between *completely disagree* and *disagree* as big as between *agree* and *completely agree*? Although social desirability and measurement-technical aspects can be serious limitations, there is, in my opinion, a much more serious objection: the measurement creates its own reality.

Suppose you want to know what the average European thinks of a completely idiotic position, for example daydreams are yellow, or blue. You ask an institute for opinion polling, which selects a representative group of respondents and presents both statements with 5 answer options each (from totally disagree to completely agree). After the survey we have an opinion: most people find daydreams (just a little) more blue than yellow (or the other way around). In this case it is clear that this is nonsense, but if a stakeholder starts marketing daydreams with the colour yellow (or blue) he may create a new reality: the association between daydream and blue. A psychologist interested in individual differences, may add a new dimension to personality psychology: people who think daydreams turn yellow are often the people who believe more in change, for example. Or something arbitrary different ...

Now you may say this is nothing but nonsense and flights of fancy that, at best, may be content for a television show or commercial advertising folders. But did you ever wonder why, for example, despite investing of millions of research funding, there is still no clarity regarding the definitions of many (psychological or psychiatric) syndromes such as Autistic Spectrum Disorder, or ADHD? Could it be that, at least partly, the syndormes consist of psychological realities created by Likert scales (unconsciously)? Questions with Likert scales are also often used to diagnose these psychological syndromes. That is why it is important to determine to what extent the "etiquettes" create their "carriers".

4.3 If-then-else

People have a cognitively built-in mechanism to explain success or failure from (a chain of) "if-then-else" rules. *If* a certain song becomes a hit, *then* it will be "better" (more original, exciting, musical, etc.) than almost "all other songs" (the *else* condition). Or if a child does well at school, it is smarter than the less performing children. Implicitly we often base opinions and even social-scientific 'facts' on such causal constructions. For example, we may be searching for the secret ingredients of a hit, or of success at school. But is it possible to explain social realities like failure or success logically? Is Madonna really the best female pop singer because of her success? Are people in the western world really the most enlightened people because of their wealth?

No! Remember the virtual hourglass with an infinite stream of grains of sand from chapter 2.1.Whether a song is successful or not, depends on a lot of largely random factors and circumstances. Although a production company "thinks" that it can control these factors to a certain extent (choosing the right number, connecting to a collective feeling after a certain event, season, etc.), most factors are in fact "coincidental". However, time and time again they will prove to be right when they succeed. And thus the success becomes part of the soundtrack of our collective lives, and we are attached to it for the rest of our lives. The transition from, for example, pop musician to pop star, concerns a discontinuity, a phase transition. The same applies to the transition from schoolchild to problem child (or child with recognition for an alleged talent). There are also recognized determinants here (school, family, remedial teaching, etc.). This can be beautiful, but also extremely annoying.

Not only does (coincidental) success create itself, bad luck and misfortune tend to do the same, devised and maintained by our *if-then-else* thinking. For example, participating in an unproven practice may be beneficial as long as the participants believe in it. The belief in success combined with the fact that no one is constantly unlucky, will lead to a more favourable interpretation of new events. This mechanism is working fully in mental health care. If someone feels so depressed that help is sought, it can probably be (slightly) easier to get better than to get even worse. The therapy, which the doctor and the environment believe in, receives the credits, regardless of the content. Anything that is believed to help will help, because everything - even inadvertently - tends to "regress" to the average. It does not matter whether the approach consists of conversations with a shaman, homeopathy (drops diluted so that they cannot possibly leave traces), prayer healing, or behavioural therapy. The difference with placebo is the collective belief in the therapy, as a result of which framing helps interpret new events as steps in the improvement, the road to (more) success, or happiness. Prayer healing and homeopathy will not be "believed" and confessed by many contemporary academically trained doctors and psychologists, hence "scientific evidence" is not provided for this.

My concern is to reflect on our human inability to separate success and failure, from both the people concerned and our own control. We are like the birds that have a nest in a tree along a road, and scare away every occasional passing car. They have 100% success: no car ever "grabs" the nest. As long as there are not too many cars, they will keep faith and continue this practice. Our control is also much more illusory than we realize. For example, we often regard our wealth as our merits, living in a world where we generally have access to education, food and other sources of life. If that is the merit of people, it is especially that of the people who lived in much less wealth in earlier times. And our happiness requires a disproportionate burden on the planet and sometimes gives rise to unhappiness for other cultures. It is therefore important to try to understand this simple psychological mechanism - our ingrained if-then-else thinking that is always getting it right afterwards!

4.4 Normal or not normal, that's the question?

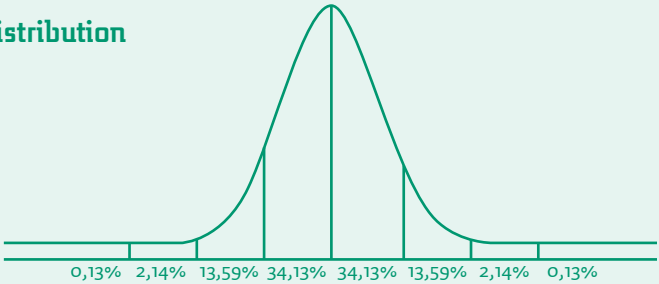
If my performance on a specific domain is very good or very bad, how does this relate to most other people? Normal or not normal? Something is normal if it's positioned between 1 standard deviation (SD) below and above the average. Abnormality is created outside the average zone (disorder/disease, or talent/excellence). According to philosopher Michel Foucault (1926-1984) normal distributions are instruments in modern control technology (Foucault, 2006). In the 18th century, control technology emerged in architecture in the dome prisons, invented by Jeremy Bentham in 1791.

In the panoptic, isolated (criminal) individuals were made visible for the corrective power. The prisoners sat in individual cells, continuously monitored by a jailer from the centre of the circular complex. According to Foucault modern power is continuously present and therefore opposed to old centralized power of regents. Let's first focus in on normal distributions in order to understand both that human scientific power is built on continuously monitoring and that disorders are certainly just as much produced as "discovered".

Normal is a concept that stems from two very interesting mathematical concepts: the normal distribution and the central limit theorem. People possess infinite numbers of properties. By far the largest number of them are unknown, they don't matter to our reality. However, through our knowledge systems - perception and thinking - we transform infinite into finite: height, weight, intelligence, kindness, wealth, strength etc. The sum of a large number of independent variables forms a normal distribution again. Think of a Bell curve that is the highest in the middle. If you measure the surface

underneath the curve in equal vertical columns, it will evolve from low to maximum halfway to low again at the end. The highest point, the average, is halfway. A normal distribution has fixed properties.

Normal distribution



IQ	45	60	85	100	115	130	145
Standard Deviations	-3σ	-2σ	-1σ	0	+1σ	+2σ	+3σ
Cumulative Percentages	0,1%	2,3%	15,9%	2,3%	2,3%	2,3%	2,3%
Z-scores	-3	-2	-1	0	-2	-2	-2
T-scores	20	30	40	50	60	70	80

If sufficient measurements are made almost everything, no matter how arbitrary, is normally distributed: the length of trees, blades of grass, people, or the age of inhabitants of a certain city, etc. Once you know the mean and the variance, the distribution is known (for instance 68% of the observed characteristics is normal: between 1SD below and above the average). Above 1SD one is for instance smart, or obese. Notice that also completely arbitrary properties can be captured in a normal distribution. However, ethical labels such as justice are not properties of the distribution. When it comes to wealth, the same distribution applies. From this it can be deduced that for example the 1% richest people own more than the others. Enter any other property for wealth and the distributions can be made again. In fact, this "game" of distributions around attributes has given birth to a life of its own. The position and power of human sciences are largely derived from this. The image of the normal (healthy) person is produced at the expense of everyone who deviates from it. And precisely this power surrounds us, in the lifestyle magazines, in education, in psychology, in pre-school ratings and in insurance premiums, like Orwell's 1984: big brother (Dr. Psych) helps us to become normal again (opaque, but always present).

From birth we are positioned in various rows (distributions). Fortunately we usually end up somewhere in the 68% margin around the average. We are either normal, or disturbed or gifted. Precisely because we all internalized normal distributions individually, we are submissive to the distributions without resistance, just like the prisoners in Bentham's dome. We've become our own and the others their jailers and big brothers: we can always be seen, but never know when we are watched. Certainly human sciences are not value-free. They hide the fact that distributions are side effects of mathematical descriptions of traits. Every person can also be described in qualities in which (s)he belongs to the absolute top (and minimum). However, probably humanity isn't interested in those distributions in which you achieve the top. But then again, being neurotic, being rich, or being intelligent according to an IQ test is ultimately also arbitrary.

Nowadays we are constantly being digitally surveillanced (allocated to virtual distributions) by among others advertisers and service providers. It's inescapable. To at least some extinct, psychology and psychiatry creates its own disorders and services through normal distributions, and in itself that is not much more scientific than the shamans or of yesteryear!

Box 7:

What we don't understand.

We see what we expect to see. For example, if we're interested in a certain type of car, "suddenly" we see many more of these cars than before. This bias confirms the correctness of our interest, hence it's called confirmation bias. In itself this isn't a problem, in looking through our "rose-tinted glasses" we see our version of reality confirmed more firmly than it actually is. It may help us to feel confident about our choices and ourselves. However, also journalists and (other) academics (professionals and scientists) are only human. Things can go wrong there. From childhood I have an interest in people who are different, perhaps precisely because it became clear when I was still very young that I myself was a bit different. I became interested in people with for instance (misunderstood) talents, deviant social "understanding", extreme shyness and social anxiety, extreme tics, very busy behaviour etc. Meanwhile I stored many biographies in my head: inventors, artists, scientific geniuses and even dangerous criminals. (I have very little interest in sports.) When unusual things happen, there must be someone to honour or to blame. Often, incomprehensible and bad behaviour is related to unusual or a-typical

persons. Half a century ago - when most car drivers were still males - a car accident was related to gender ("women at the wheel, blood on the wall"). Moreover, criminal behaviour became related to cultural backgrounds, race and, more recently, mental conditions like ADHD. At present, such behaviour is increasingly related to "autism". In the Netherlands, for example, a 13-yearold boy murdered both his parents. In America, a 19-year-old school shooter killed 17 pupils. In both cases, almost immediately one was speaking of strange behaviour and autism. Just pay attention, it happens constantly. Until 15 years ago, it was often assumed that perpetrators suffered from psychopathy, later borderline personality disorder and then hyperactivity (ADHD). In the Netherlands, in 2002 the suspicion turned to autism when a person who should suffer from Asperger syndrome murdered politician Pim Fortuyn. To my own great dismay, I realized how awful this verification error could be. Almost immediately I realized what it must feel like to have a different cultural background and to be seen as a criminal beforehand ...

We want to neutralize threatening things as quickly as possible so that we can safely continue our lives. Our inborn confirmation bias helps with this. The deviant is interpreted in a label that we think we understand, and then we see it continuously confirmed. It's just like the cars from the introduction. If something criminal occurs, first we search for minorities (cultural background, psychopathology). If possible, we verify our prejudices. We do not falsify. The greatest leaders of the last century - for example Nelson Mandela, Gandhi and Obama - were not white people! For both people from completely different cultural backgrounds, and people with a psychopathological diagnosis, often extra effort is required to successfully connect with society. Stereotyping and prejudices surely do not help.

Through falsification, confirmation bias can be unmasked. The statistics of insurance companies show irrevocably that men drive cars no better than women. On the contrary, relatively men are far more often involved in accidents than women. Three decades ago, autism was seen as an intellectual disability. The careers of many scientists falsify this idea. A new prejudice is emerging: the combination of being autistic and having a good job indicates intelligent strength. There are lots of a-typical people who make a difference in a positive sense. These examples falsify thinking in disorders. However, citing these examples without changing theorizing about "differences" (still "understand" them as disorders) is certainly not without risk. Often a-typical people do need support to connect with the others, or society, and not only autists. Even women, not a-typical at all, sometimes need support. Even though women do better than men on average in countless aspects like school and in traffic, they are still heavily under-represented in top positions. Every day psychologists, psychiatrists and teachers do lots of good work for people who are atypical. But ultimately a theory based on confirmation bias should be falsified!

Odette Fremouw: Strangers

5. A case of autism: Beta talent forward

In this chapter we apply the idea of argument-based practice to autism. Often, applied science is practiced on the basis of alleged "evidence". Often, argumentation plays a much less self-evident role than would be expected. In psychopathology, "empirical" characteristics - criteria - are linked to an (alleged) syndrome. Subsequently evidence is sought for the presence or absence of these diagnostic criteria. However, there is a risk of tick-off lists and stereotyping, because the emphasis is much on the "evidence", and far less on the argument. In other words, argument based practice is trying to understand a situation ("evidence") by applying argumentation. You would think that applied science always comes about like this, but the opposite is true (see chapter 4.2 and 4.3). In argument based practice both evidence and argument play a role, but the argument is decisive.

Autism, or more precisely, Autistic Spectrum Disorder (ASD) is diagnosed on the basis of the DSM 5 psychiatric handbook. There are 5 criteria: A. Persistent deficits in social communication and interaction, B. Restricted, repetitive patterns of behaviour, interests or activities (including "highly restricted, fixated interests that are abnormal in intensity or focus "), C. Symptoms must be present in the early developmental period (but are sometimes recognized only later), D. Symptoms cause clinically significant impairment in social, occupational or other important areas of current functioning, and E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder), or global developmental delay.

Although ASD is diagnosed on the basis of the DSM 5, the criteria are so ambiguous that it is not easy to determine whether anyone has "ASD" or not. This is remarkable, because on the basis of criteria, it is clear from a number of issues whether or not something or someone complies with it: the presence or absence of a hydrogen atom in a compound (water does, rust doesn't), whether or not you possess a female sexual organ (women do, men don't), whether or not you have PKU, etc. To determine whether someone meets the criteria for ASD, a specialized doctor is needed, while a child of 6 can determine whether someone speaks English with a Dutch or American accent.

So not anyone is able to determine whether a specific person does or does not meet the criteria for ASD (despite the fact that they're listed in the DSM). This is because a presumed criterion (for instance shortages in social communication and interaction) can manifest itself in many ways: one person hardly speaks, while another person never stops talking about his/her misunderstood fascinations. Anyway, there are people ("autists") who have been diagnosed with ASD by psychiatrists. Most people do not have a diagnosis of ASD. Some of them might be able to get a diagnosis. If we now limit ourselves to people with a diagnosis, then we can ask ourselves whether they are all outside the society in a similar way?

A short tour through "ASD in real life" gives an unambiguous answer: no! Some people who once had a diagnosis of ASD are world-famous, such as "Brainman" Daniel Tammet (also diagnosed by the autism expert par excellence prof. Baron-Cohen). Meanwhile, Daniel has written a small bookcase full of bestsellers and performs as a speaker around the world. Other successful people with the diagnosis of ASD are easy to find in various disciplines, from rock stars to Nobel laureates, from film stars to entrepreneurs. Hans Asperger, along with his colleague Kanner the "inventor" of the diagnosis of autism, described with his own patients that they were fascinated at a young age by something that was difficult to understand by the outside world. One of his patients later became a world-famous professor of astronomy (Fritz V.).

However, if we look at people diagnosed with ASD, apart from these exceptional talents, we can also see diagnosed individuals who are not successful and sometimes even completely out of society. The NVA (Netherlands federation for autism) together with the Free University in Amsterdam, has calculated that 19% of adult autistic people do not have day structure (no work, no day treatment; Begeer, et al., 2013, p. 57). Are these the most severely affected people with a diagnosis of ASD? Then it is good to see how the cognitive qualities within this group are, since Hans Asperger assumed special cognitive qualities as a core feature.

Indeed, even in this most affected group many people still have above average qualities: 63% have an IQ above 115, 20% above 130 (so highly gifted). An IQ of 130 or higher occurs in the normal population about 2.5 times per 100 people. Evidence for the link between the diagnosis of ASD and high cognitive capacity can also be found elsewhere quickly. For example, ItVitae (a nationally known trainer of people with giftedness and a diagnosis of ASD to a job in the high-tech ICT industry) has been filled with candidates only a few years after its foundation! A registry for physicians with autism, which was set up two years ago by a general practitioner with autism, also had more than 100 "members" in the Netherlands after just a few months. But an argument based practice not only verifies, it also falsifies! And then the whole "house of cards" threatens to fall!

Perhaps the cheapest hypothesis is that people who have all become famous with a diagnosis have had their diagnosis by mistake. Perhaps their (high) giftedness, or individuality (geniality) in the early childhood was confused with autism, which they later grew over.

But if a high IQ occurs structurally more often in a group with ASD, could autism be an IQ enhancer? Sometimes it may be, but also often it isn't. There are also people with a diagnosis who do not have a high IQ or do not have clear cognitive talents. In the just

mentioned most affected group, 35,2% of the "home sitters" have an IQ of less than 115, of which even a part (7,3%) lower than 85 (in normal population 16% score an IQ below 85)! Now we are faced with a problem: We have an adjustment disorder, which can only be determined by very well-trained professionals, but whether having a diagnosis leads to isolation, or high achievement (to handicap or to a Nobel Prize), is not clear: both occur. We may wonder what is most common?

"Handicap", many psychiatrists and psychologists will say. However, there are at least as many diagnosed persons who are happy with their lives and achievements now. Of course, after a few decades of autism research, lots of things have been mapped out: on average, people with a diagnosis are more intelligent than people without a diagnosis, people with diagnosis suffer more from depression, addictions, and Obsessive Compulsive Disorder than people without a diagnosis. In the highest-scoring group of gifted individuals, the diagnosis of ASD occurs significantly more frequently than in the "normal" population group, etc. LGBT occurs significantly more often within the group of people diagnosed with ASD than in the "normal" population group. But if you look at the studies committed on other "disorders" (eg, giftedness or hypersensitivity, not even an "official" diagnosis), similar deviant associations can be found with regard to characteristics such as intelligence, (other) psychopathology, LGBT, suicide, etc..

In the meantime, autism is just as much a "diagnosis" of the public as of psychologists and psychiatrists. For example in dozens of series, "autistic" (or Asperger-inspired characters) shine in the starring role: the Bridge, the Good Doctor, Bones, Elementary, Sherlock, Touch, etc.). Enhanced (cognitive) achievements, savant behaviour, in combination with bad social skills is often part of the public view. But scientists often focus on disabilities instead of on special strengths, even though Hans Asperger saw exceptional cognitive abilities as key quality from the very beginning of describing autism. The diagnosis is now perhaps even more publicly owned than that she is still scientific. There are reasons for this: lack of clarity and lack of argument.

In conclusion, there is a highly ambiguous situation. Only a small percentage of highly educated professionals can diagnose ASD. However, after being diagnosed still a multitude of possible future scenarios exists in terms of qualities, happiness, success and other factors such as co-morbidity. The cheapest conclusion is that the diagnosing professional group itself is the cause of the confusion. The fact that there is something different about some people, who less automatically connects to school, work, hobby, etc., is often agreed, even though it may be temporary and caused by factors other than an alleged disorder (divorcing parents of which a schoolchild is a victim, poor nutrition, or (social) hygiene, for example). In this application chapter we will argue about autism from our project "Beta talent Forward".

5.1 The 4 requirements reconsidered in relation to a Case of Autism, all through our lifespan

In chapter 1, argument based practice was called the third requirement that must be met to evaluate technology (in the case of diagnosis technology is methodology). Before continuing with evaluating autism in the casus *beta talent forward* from the idea of a practice-based argument, we consider the diagnosis of ASD as a method and with that, (living) technology in relation to the other requirements.

Requirement 1, the sustainability aspect

Hans Asperger was born in 1906 and died in 1980. In 1944 he was the first to describe the diagnoses Autism. He did a case study about four children he followed for many years. They all exhibited both extraordinary cognitive (mathematical/formal) talents, and disabilities in social skills (interaction). In later "updates" of the diagnosis (from doctors other than Asperger), the idea of strong cognitive skills almost completely disappeared, to return to the DSM 3 as high-functioning autism and Asperger Autism. Meanwhile, in the DSM 5 all subtypes have been converted into 1 type, ASD. Some 50 years ago people even spoke of an "intellectual disability", but that is certainly no longer part of the diagnosis. As we have seen, however, there are clear indications of an increased intellectual capacity among people with ASD, which is not taken into account in diagnostics. The image from films, series and popular books (part of public opinion) seems to be more open to this aspect. On the other hand, the autistic person seems to have remained relatively unchanged over the years, although many more people are now diagnosed than about 2-3 decades ago. All in all, requirement 1 (sustainability) is reasonably met.

Requirement 2, the technique (the diagnosis) must not block development. When children are diagnosed, it is intended to help children to overcome developmental disadvantage at the social level. Often the focus is only on shortages and hardly or not at all on strengths (see requirement 1). But because there is so little argumentation, the variable picture cannot explain why there are also many people who have become successful despite a diagnosis. So this aspect is overshadowed by *requirement 3*, the argument. It is for this reason that we focus on this in this last chapter. The developmental requirement 2 is also closely related to dynamical system theory (chapter 2): non-linearity. Less may become more. A slower start eventually leads to greater performance. Investing on disability instead of on strengths (because the weaknesses are clear to everyone) may indeed block development. Sometimes it may take much longer for a seed to germinate and grow, as we saw in chapter 2. Finally, *requirement 4*, the discourse aspect, is about the dialogue between the people diagnosed with ASD, the experts and the public to

find common and better understanding. The fact that the diagnosis may have become even more of the public than of psychiatry / psychology shows that things are not in balance here either. Nevertheless, the lack of a logical foundation - the argument - is overdue.

5.2 Flexible intelligence

In an episode of "Elementary", the American version of Sherlock Holmes on Netflix, Sherlock notes with regard to a very complicated case: "Some problems need flexible intelligence to be resolved". His remark reminded me of Jay Belsky's model of "genetic differential susceptibility" with regard to nurture influences. The idea is that some people genetically have more potential mental flexibility than others, and that this can mean both an advantage and a disadvantage. Genetically, it is useful for a species if many properties that are necessary for survival are anchored in the 'hardware' (DNA) of the individuals. However, species that offer a lot of space for nurturing and education, such as pre-eminently human beings, a hardware system is required on which many different "software systems" can be developed and played. Belsky's model of genetic differential susceptibility states that some individuals have extra flexibility and, in his own words, this is "for better and for worse".

For susceptible children, appropriate education and the right circumstances are of the utmost importance, even more than with "normal" children. In wrong circumstances things can easily go wrong. But under favourable conditions these people can reach the top. A bit like Formula 1 cars, which still have to be tinkered up to the circuit, while on the track the performance is unprecedented (if you're lucky)! However, every car, no matter how cheap it is, is better suited for shopping, or city traffic. According to Belsky (Belsky et al., 2007), individuals who possess this extra flexibility would be emotionally less stable and, for example, susceptible to addiction, extreme shyness, social isolation etc. From their environment, more support is needed in order to develop well (just like the formula 1 cars need technicians even on the track). This brings us back to Sherlock, who describes himself as an ex-addict, a high-functioning sociopath, or a neuro atypical person (Asperger), but with a high degree of intellectual plasticity / flexibility. In order to function, he needs Dr Watson continuously as "assistant", 24 hours a day. In the American version, the doctor is a female surgeon - Joan - taking a sabbatical. She accompanied Sherlock as a buddy after his withdrawal from an addiction. She structures the life of Sherlock and he never lets her go.

This hypothesis may shed a very different light on high-functioning autistic and other a-typical individuals. A formula 1 car is not a deranged shopping car, but an extremely developed and sensitive high-tech machine that needs attention and support to reach maturity. Designed to reach the top and yet worthless in the wrong place. A radically different way of thinking often underlies major developments for humanity. Formula 1 is at the same time an individual sport and a team sport par excellence. Neuro atypical people are often individualists, but they need others and solidarity. Of the 19% people with autism who don't ever go to work or even don't have any kind of structural day-care, 43% have an IQ above 115 and 21% even over 130. They need help to find the right circuit, and that starts with recognition. Recognition is not the same as denial, there is indeed a problem, but there may also be unique opportunities for each individual!

5.3 Part time autistic?!

Let's begin with the question whether someone who develops autistic behaviour as a child will always be autistic. In other words, can autism also stem from temporarily narrowed (changed) information processing, for example in response to situational difficulties?

Imagine, you look through your telescope in the dark night at the galaxy, or at least, at what you can see of it. It's a chaotic pattern. Thousands of dots that look like randomly scattered salt grains on a black tablecloth. Between the many thousands of dots, next to none is the chance that you will notice that 1 star - 1 grain of salt - flashes (a supernova), disappears or has disappeared. And what if you do not have to monitor 1, but 1500 different galaxies (1500 tablecloths in a row)? Can you walk past it, about 2 miles, to recognize exactly that spot on that one table where 1 grain of salt has disappeared? How enormous must your memory be to remember all those systems in such detail? In his book "An anthropologist on Mars", neurologist Olivier Sacks (1995) describes an autistic savant who can do exactly that: Robert Evans (born 1937). A very exceptional talent, he has discovered more supernova's than anyone else!

In the course of life of people who develop so differently from normal, sometimes nothing seems normal: children do not reach the milestones or otherwise, do not want to be touched, or remain mutist for a long time, or their fascinations are grossly misunderstood by parents, school and peers. They show no or little interest in ordinary, "age-conform" things. There is no unambiguous cause of an "autistic" development. A wide variety of issues are mentioned in research: abnormal intestinal flora, birth trauma, caesarean (!), Infections, air pollution, gender, testosterone balance, genetics, or external factors such as

upbringing and disordered sleep. Autism may be primarily a syndrome, or a symptom. But a non-neurotypical (a-typical) development is characteristic that in turn results in a rather specific (typical) pattern: the autistic.

In children with autism, hyper focus (negative named fixation) is often involved. Keeping the still misunderstood world outside and focusing on a potentially more predictable aspect - the misunderstood fascination - is an understandable response that can be evoked by both external and internal factors. Such a-specific (temporary or non-temporary) factors behave as a control parameter. It is precisely here that very special patterns / competencies can sometimes arise or be developed. Less becomes more, even if autism is a symptom and is of a temporary nature! (Most of us behave quite autistic with e.g. heavy headaches!). It is quite possible for a child to close off in development for a number of years and develop special talents from the hyper focus. Precisely because development cannot be aimed at all areas alike, such a child runs in a different timetable than the peers.

Although many aspects of development can also be picked up at a different time, this does not automatically result in the "neurotypical" (normal) pattern of peers. A child who turns the children's bicycle upside down and stays fascinated for months by the interaction between wheels, pedals and chain, perhaps builds a basis for insight into mechanics, but lacks the experiences of the children who cycle towards each other and thereby exercise age conform complex interplay. Whether this is positive or negative (strength or limitation) is partly dependent on how the child, family and education system can integrate the difference and how things are picked up at the right time. Trust, insight, diversity and understanding must then be the starting point.

Back to Robert Evans. Oliver Sacks never seems to have visited the man. The writer Bill Bryson ("A very short history of nearly everything") did, and he found a neatly socially integrated minister, happily married for years and still active for his congregation (Bryson, 2003). On Bryson's remark that Sacks had staged him as an autistic savant, he shrugged good-natured ... Or would Sacks be right? After all, nobody has traced so many supernovas as Evans. Would the origin of this gift have been an autistic episode of a passing nature?

Suppose autism is a kind of default mode, such as the energy-saving mode on your smartphone, where every nervous system may switch to in case of[1] internal or external "difficulties". During the default mode things can go wrong (standstill or decline), but also development can be facilitated, e.g. by hyper focus. The power of limitation; less is more! In a world with so many stimuli and unlimited possibilities, more easily children

come to the default position (causing a huge increase in the number of diagnosed). From a neuropsychological stance, every talent is a-typical![2] Our world is crying for (technical) talent, and because of this the general image of autism is shifting. Of course I know that differentness leads to polarity: besides beautiful, special lives, there is also that other side, from sadness and misunderstanding, to deep misfortune. Anyway, the time is ripe for our (pre-) judgments about determination and causality - autism is a disorder - to enrich it with insights from modern non-linear dynamics. That is, coincidence and unexpected turns do always play a role!

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[1] The limit values may differ, e.g. with the gender, such as the temperatures of metals with regard to the condition (mercury is already liquid at room temperature).

[2] Developing talent requires dedication, rehearsal and devotion; autism as a method.

Box 8:

Brain and technology

With regard to my chair "brain and technology" the Danish philosopher Kierkegaard (1813-1855) cannot remain unspoken. He was an astute genius who foresaw the effects of the "technologicalization" of society: "I will only be understood long after my death, if a few politicians manage to force unnamed crowds into soldiers' boots and Europe will be bleeding from the consequence of both nationalism, and mass production" (in Scholtens, 1972).

In 1846 he made another important statement in this context: "Ultimately, all destruction will come from the natural sciences." Kierkegaard warned that both technology (technocracy), and the emergence of the crowd would be the "abortion on every form of originality". According to him, the subjection to technique (machinations) will change the common man into a directed crowd, characterized by boredom, fear of loneliness, fear of being different, fear of originality and fear of death. Although these statements are almost 200 years old, they are still surprisingly topical. In what way is this shift from individual to crowd possible?

In his popular book Thinking Fast and Slow (2011), Nobel prize winning psychologist Daniel Kahneman describes two systems of thought. System 1 is fast and automatic and based on intuitions, wordless comprehension and first impressions. On the other hand, system 2 always requires cognitive effort - thinking - and giving conscious attention to things. System 1 is low energy consuming and works in parallel: many processes can be processed simultaneously. Because system 2 works serially - central attention is like a focussed spotlight - it is both slow and energy consuming. That is, because there can only be attention for one aspect at a time central attention costs relatively much energy. After a lot of training, system 1 can eventually be controlled by system 2, so that we will have to rely less on first impressions and gut feelings. This is a necessary precondition for both competence, and individuality/ authenticity. Both systems are crucial for development.

After a lot of training, system 1 can eventually be controlled by system 2, so that we will have to rely less on first impressions and gut feelings

It is possible to link the balance between system 1 and 2 to the increased number of diagnosis autistic spectrum disorder (ASD) in the last decades. People differ during their development and also in relation to the relationship between system 1 and 2. Autism could be described as a different balance between system 1 and 2. The tacit, automatic understanding and intuitive feel of system 1 is the main everyday system to most (neuro-typical) people. However, the autistic person enters the world mainly from system 2. Precisely because the world has become "auto-mated" through technology and globalization, people who do not participate automatically and who are less controlled by such automated machinations, are all the more striking. As a result there is an increase in the number of diagnoses ASD, with a "catch-up" in adults.

Incidentally, a paradox is visible here, to be able to invent, program and understand the formal language from which technology and science are generally understood and produced, system 2 is important. As a result, people with ASD are indispensable in the high-tech industry. However, to fit in the "machinations", system 1 is of utmost importance. Although there is an increase in the number of diagnosed ASD diagnoses, to return to Kierkegaard the increase in neuro-typical people is actually the real problem. Many people seem to enjoy their role as "consumption cattle", while every human being has the possibility to become a unique (authentic) individual. The crowd is untruth, Kierkegaard said, and that sheds an extra light on what could be called Neuro-typical Spectrum Disorder. A neuro-typical crowd has arisen that is guided by technology (strongly depending on system 1). Nowadays many people believe bio-determinism that states that we are our brain! There is even a company that claims to be able to derive a good job from a brain scan: brainfirst!

5.4 Energy saving mode

Over the past decades, three theoretical autism frameworks have emerged: (1) the Theory of Mind (ToM), (2) the weak central coherence theory (WCC) and (3) the extreme male Brain theory. Professor Simon Baron-Cohen, the international autism expert, put forward the first theory: ToM. Children get to see a series of pictures: a boy hides a toy in a locker and goes outside to play. His mother takes the toy and puts it in another box. The question is where does the boy look after playing, (1) at the place where he has hidden it, or (2) at the place where it is now. Autistic children would have no or less theory of mind and so choose 2. One speaks of an impaired empathy.

The second theory, WCC, states that autistic persons have problems in seeing the big picture, a poor common sense and bad judgment (unable to read between the lines). However, Baron-Cohen (2006) noted in the course of his career that people with autism could also become very good at certain things, including analysing and thinking out of the box, and began to see autism more and more as a variant instead of a disorder. He came up with a new theory: the extreme male Brain theory. Autistic persons would be very good at properties that are often associated with cognitive male characteristics: analysis, formal thinking, thinking in object relationships (hierarchical instead of relational).

A study (Begeer & Wierda, 2013) conducted by the Free University of Amsterdam and the Dutch autism association (NVA) shows that of the most affected group of autistic persons - the 19% without a job or any other structural day-filling - 43% have an above average IQ (115 or higher) and almost 20% score as highly gifted (130 or higher). This seems to support the theory of Baron-Cohen, an extremely specialized brain, which is not automatically usable in "daily use" and therefore leads to disability. High-tech companies have discovered the potential strengths of gifted autistic people. They completely relieve these employees, so that the autistic experts can do what they do best: programming smart algorithms, coming up with new solutions, detecting errors in code, hacking, etc. There are even schools that train gifted autistic people to become programmers, and they are currently very successful!

Yet not everyone with a diagnosis of autistic spectrum disorder is an undiscovered genius (a disguised Formula 1 car). And for good reasons ToM is largely nuanced, while some autistic experts are hired for their strong central coherence (for example with Google, Microsoft and other tech giants as system designers). However, a lot of research is done on autism, and there are a lot of circumstances "discovered" that can potentially "evoke" autism: air pollution, a caesarean section, etc.

Maybe it's time for a new framework. Apparently autistic "symptoms" (hyper focus, repetitive and stereotyped behaviour, not understood fascinations) form a kind of "default" state, in which our thinking and behaviour - brain and body - canalizes under

specific circumstances. The default mechanism - the energy saving mode - is latently present in everybody, but in some people it is easier to reach than in others. In case of severe headaches, for example when someone still has to continue to function, many people will show autistic characteristics, but then of a temporary nature. Circumstances can be more and less temporary. The default mechanism makes it possible to survive with less energy (load). Some people may switch to the "default mode" easier than others. A bit like mercury that is already liquid at room temperature, while iron has to be heated to a few thousand degrees to show the same liquid dynamic properties.

In the "default mechanism" idea, many factors can trigger the switch. For example, air pollution, intestinal flora, genetics or Caesarean section and many other factors can lead to a switch to the autistic default mechanism. There may be a kind of sensitivity to autism, or at least autistic episodes. Autistic behaviour may be a temporary answer of the organism to (too high) requirements (such as functioning with migraine). Although it will often limit the developmental outcomes, it can, under favourable circumstances, give a huge boost to development, at least in certain areas. There is differential susceptibility! Autistic children and adults learn differently from neurotypical people, and so success or failure depends much more on help / support from the environment (home, school).

5.5 Application, Beta talent forward

After more than a year in our Beta talent project, one characteristic of the candidates seems to be more common than any other: a lack of confidence in working in teams. As stated before, the project is intended for people within the autistic spectrum with excellent (cognitive) competencies, who nevertheless cannot find or keep a job. At first I was inclined to view the problem primarily as a problem of the current social structure of labour. Admittedly, many candidates are original thinkers who are not always willing to let go of their own way of thinking to go along with those of others. At the same time, using the power of teamwork has become much more prominent today than when I was young.

From a very young age, collaboration and finding solutions in groups is already part of the educational programme. Our candidates are often specialists in independent thinking and working on their own. Because this is being asked so little now - work is mainly done in 'teams' - they tend to stand still. But when ultimately something individually challenging is asked for, they don't know how to stop. They're running into extremes. In standing sill their motivation "leaks" away and they fail, concluding that they have poor planning skills. Most candidates have learned to put the blame on their "autism". But is that right? Here I am inclined to a rather cowardly answer: yes and no.

If craftsmanship in the field of thinking (philosophy, logic, mathematics) and design (STEM: science, technology, engineering and mathematics) would be seen as mainly individually developable complex skills, as it was in the past, poor planning skills (and side effects like failing self-care and regulation) would largely disappear as snow in the sun. But honestly, in some of our autistic candidates the willingness / ability to share with the other team members is much too small. Of course there are always isolated geniuses that generate world-shaking innovations from scratch. But more than ever before we live in a network society. If the candidates really increased their willingness to form a team together, they would have much more success in the area of labour (re) integration. We work together in the beta-talent project and I think it is one of the most beautiful projects I've worked on so far. This is so difficult for our candidates, the dilemma between the reduced need to share in a team and the high need to be appreciated.

It is a vicious circle. Suppose you're an autistic genius. You are valued for your "talent", for example your ability to formalize problems. You have invested a lot of time and energy to reach your current level. With these typical "autistic" specialisms this means you've spent a lot of time in isolation. You've never learned to trust in teams and now you must hope that the team will accept and respect you. Many team members are so socially competent that they take good care of themselves and thereby act as if they put the interests of the team first. Of course you do not understand this social "game" yet. You see 'macho' team members who claim your earnings for themselves, which makes you both angry and even more insecure. Until you scream that the other person shows off with your feathers. And that is, again cowardly formulated, as true as false. You have proven to the team that you are "just" a nerd with an autistic "meltdown". And you have proven to yourself that the team cannot be trusted. How can we change this?

All of our beta talent forward candidates possess remarkable (intellectual) qualities. In our time, however, more and more processes are dependent on the intellect of the group (tribe) and less on unique individual qualities. Ultimately, no individual can compete with this collective intelligence, no matter how smart you are.

Take Wikipedia as an example. Anyone can contribute. If it is not right, without an editor in chief, "the tribe" corrects the content. Nevertheless, Wikipedia has surpassed all traditional encyclopaedias in terms of quality and completeness. The organization of hospital care can serve as another example. No longer does a patient have to deal with the exceptional talent of one doctor - or a sister Nightingale - but with a bunch of perfectly collaborating team players, utilizing the strength of the group. ICT plays an essential role in this. Recently, I was in hospital with my parents-in-law, and after a few hours we had spoken to 16 health care professionals; the acute danger was systematically detected

and treated. After a few hours the danger had completely disappeared. In working as a team, healthcare professionals do not even have to know each other by name.

Back to our participants. The difficulty with going to work is in part that they are perfectly capable of great intellectual performance, but that they often unconsciously and unintentionally place themselves against the intellect of the group. And then they come into a position, or "battle", that they can win less and less easily. The question now is how our autistic beta talent candidates can use their powers as part of the "tribe", so that they reinforce the team's intelligence.

Two perspectives. The first comes from the scientific literature. American professor Amy Edmondson (2009) has researched the conditions a team must meet if people who do not know each other have to work together successfully. Think of a rescue team. These are completely different processes than a perfectly matched team that acts as one machine, such as a band, orchestra or football team. New and unique situations require unique and often individual talents, just like the talents of our candidates. The solution is not present in advance. Autistic people can play an essential role (and often do so, as we know), but as stated, they sometimes have difficulty getting involved in the team. According to Edmondson, each person is neurologically hard wired to act on the assumption that he / she already possesses the knowledge to solve the problem. This is even stronger for specialists and top talents, who are valued even more for their talents. If they feel insecure because they differ from others in many ways, they have at least their highly valued knowledge and abilities. But someone who knows is not really open to learning, whereas in new situations the team must be allowed to assume that it does not yet have the answers. This is extra difficult for autistic people who are often less focused on teamwork and therefore have less experience with teams.

According to Edmondson, three conditions must be met in order to flourish in a team: humility (daring to assume that you do not know), curiosity and psychological safety. The second perspective comes from by my colleague Frederieke Hermsen (anthropologist) and relates to the oxytocin levels: research shows that people can work much more easily in teams if the oxytocin levels are high enough. As Paul J. Zak (Zak et al., 2007) showed, oxytocin increased the trust among teammates. Oxytocin is released during, among other things, embracing and touching, and it is these cases that are less self-evident in autistic people. Maybe, Frederieke suggests with a wink, we have to offer the candidates regular massages under the guise of preventing RSI. Anyway, in the project we will now try to make a much more focused link between the intelligence of the group and the (unique) intelligence of the candidates. Anyone who has suggestions on how to deal with this may say: the intelligence of the network!

Putting out the fire with gasoline

(part 3)

Last week my wife's colleague told us that her brilliant daughter had left school at the age of 17 in the upper secondary education (gymnasium). The girl has already invented revolutionary new fibres, but meanwhile the schools rigid requirements to "colour inside the lines" had made it impossible for her to communicate with her teachers any longer. In this column I focus in more detail on "colouring inside the lines" and the possible consequences for young generations.

When I was a child, all children played every day in the open air, often outside the parents' field of vision. Admittedly, sometimes things went wrong. From my neighbourhood, for example, I remember a little boy who lost a number of fingers during his 'experiments' while his bike was upside down. I also remember a few diving accidents at the open-air pool with even a paraplegia as a result. And when we were 11-12 we started experimenting with old Solexes and Sparta-matics, where a little boy from my neighbourhood lost his life when he bumped into a stationary bus with the very powerful moped. However, much more often things went well. There was plenty of room to play and explore.

Recently I heard a colleague sigh, how as a child he pooped out of a tree in a quiet spot, to examine a week later what was left of it. Since the 1970s, the economy and society have enabled people to develop regardless of their gender and to contribute to society through work. However, this has changed the supervision of our growing children. Because of the great attraction of television screen, game consoles, or IPads, children are safe with relatively little supervision. The addictive effect of these "smart" devices ensures that they stay there. Fortunately, right?

No. At a young age, we "program" our children to "engage" in machine-like interaction, telling ourselves

that they "learn" to deal with smart technology. High-tech multinationals and, in their wake, politics and education, ensure us that this is important to be prepared for the future. We would like to believe it, although due to too little exercise obesity lurks, they are safe when playing indoors. However, I think this is a very bad development, which already started in the eighties (with the availability of videos and game consoles).

If children learn to get credits performing pre-defined actions in a preconceived "problem space", their intrinsic exploration drive is tempered. It is like colouring inside the lines, instead of drawing freely. And it does not get any better with age, I know in the meantime. Even in the highest classes of the Gymnasium I have experienced that my children are 'judged' by the question whether their answer is exactly the same as in the answer key. For example, it is possible that a brilliant child, like my wife's colleague's daughter with original mathematical insights, solves equations in a completely new way and fails, with only 2.7 points out of 10. After a few hours the teacher understands how she did it and that it indeed demonstrates brilliant insight, but doubts what to do. In order to appreciate her insight, he must now colour outside the lines, and he too is a child of ... the lost childhood. He finally dares to leave the Rubrics, it becomes a 10. Unfortunately, there is a new teacher in the next class who does not, and, as said, the girl is now at home. Fortunately, she has a diagnosis (ASD), so everyone can sit back and sympathize with both sides...

Even the creative subjects are increasingly about imitating and less about creating. The "Idols generation" is hardly allowed to create anything themselves, but expected to imitate, to be "the Voice of ...". On the internet, people stream fewer and fewer content (artist, memes) in ever-larger numbers. If then the art teachers ask adolescents to judge each other's performances (usually imitations of a small number of super hits), then this is more a social hierarchical game than that it has anything to do with creativity. It isn't hard to understand why there are so many cover and "revival" bands. We learn to fit in a pre-existing reality, to colour inside the lines. If a child makes something unique, there's a good chance that it will be mercilessly beaten down, over and over again, until it finally starts to imitate and colours nicely inside the lines. Only strong teachers dare to break this, but what if that is not in their Rubrics?

Still, I do not understand that we think it's crazy that so many brilliant children get stuck, and that so many children and young adults who seem to be well in line, already get "tired" at a young age, and end up in a burnout. And the solution is often seen in the use of even more programs at even younger age, even more early diagnosis. But as long as we do not see the problem - in which the deprivation of free play space (the childhood stolen by convenience and (digital) technology) plays a role - this also remains "Putting out the fire with gasoline." Cat people!

Nederlandse samenvatting

Mensen en technologie zijn al sinds het ontstaan van de moderne mens zo'n 200000 jaar geleden onlosmakelijk met elkaar verbonden. Anders dan traditionele technologie, zoals beheersing van het vuur en de hefboom (en daar van afgeleide toepassingen zoals hamers, wielen en krukassen), is smart Technology toegerust met een eigen vermogen tot adaptatie. Waar bij traditionele technologie de mens in termen van de techniek moet denken om deze succesvol en doelgericht toe te passen, past techniek met bijvoorbeeld een eigen leervermogen zich aan de mens aan. Dit betekent dat smart technologie de ontwikkeling op een andere manier beïnvloedt dan traditionele techniek.

Ten eerste is de directe fysische relatie tussen wat de gebruiker doet en wat er gebeurt - de contingentie - versluierd door het mediterend smart mechanisme (bijvoorbeeld een leeralgoritme). Het leren werken met de technologie wordt daarmee als het samenwerken met een ander, een sociale activiteit. Het mechanische, cognitieve, of logisch inhoudelijke aspect raakt geïsoleerd van de ontwikkeling van inzicht. Dat wil echter niet zeggen, dat er geen afhankelijkheidsrelaties ontstaan. Integendeel, ondertussen weten we dat leven met de sociale media, bijvoorbeeld, erg verslavend kan zijn. Ten tweede is juist omdat de smart technologie eigen leer- en adaptatievermogen heeft, onduidelijk hoe technieken door ontwikkeld worden. Er is sprake van "levende" technologie, waarbij mensen hun leven uitlenen aan de technologische ontwikkeling. De gebruiker is hierin veel minder een partij dan bij traditionele techniek. Een timmerman, of een pianist, heeft altijd veel te zeggen gehad bij innovaties van het instrument. Smart technologie kan zomaar van de markt gehaald worden en niet meer opgevolgd worden. Er is dus geen gegarandeerde duurzaamheid en tevens geen maatschappelijk discours.

Deze veranderingen in de relatie tussen menselijke ontwikkeling (brein) en smart technologie - technologie met eigen leer- en aanpassingsvermogen - heeft geleid in het verwoorden van 4 *vereisten* waar smart technologie op beoordeeld zou moeten worden: 1. Is ze duurzaam, 2. blokkeert ze ontwikkeling en zo ja, op welke wijze, 3. is er een logisch argument waarom de techniek gebruikt kan worden en waarmee de technologie uitgelegd kan worden, ook in termen van psychologische ontwikkeling en, tenslotte, 4. is het maatschappelijk en ethisch discourse op een transparante wijze in gang gezet. De vierde requirement - het discourse - bevindt zich grotendeels buiten het bestek van dit betoog. Echter, in de hoofdstukken 1, 3 en 5 is een "box" opgenomen onder de titel "Putting out the fire with gasoline", waarin speciaal op het niveau van de vierde requirement wordt betoogd. In het discourse komt aan de orde welke moraliteit (impliciet) vastligt en als waarheid wordt gezien. De 4 requirements lopen losjes gelijk op met de vierdeling in informatietheorie: 1. Data, 2. Informatie, 3. Kennis en 4. Wijsheid.

Onder meer futurologen en management guru's presenteren in sneltreinvaart "theorieën" over hoe technologie ons als mens blijvend zal veranderen. Zowel vereisten 1 (duurzaamheid), als 2 (inzicht in op welke wijze de technologie menselijke ontwikkeling beïnvloedt) spelen hier een rol. Echter, deze "theorieën" blijken niet door wetenschappelijk onderzoek gestaafd te kunnen worden. Meestal wijst de wetenschappelijke evidentie, juist de andere kant uit. Zo wordt vaak geroepen dat steeds meer disruptieve startups de grote bedrijven omverwerpen en dat het internet een verbreding van het artistieke landschap geeft, omdat schrijvers en andere kunstenaars niet meer afhankelijk zijn van uitgevers. Echter, uit onderzoek blijkt dat steeds minder artiesten een steeds groter percentage van alle streaming vertegenwoordigen, en dat sinds de jaren 50 het aandeel van grote bedrijven in het bruto nationaal product verdubbeld is. De veronderstelde verschillen tussen smart technologie en traditionele technologie (en zelfs breder, cultuur) blijken grotendeels weg te vallen. Echter, dat guru's schijnbaar zo makkelijk een gehoor vinden, zegt echter wel iets. Het laat zien dat de psychologie (en de andere sociale- en menswetenschappen) tot nog toe nog geen overtuigende duiding hebben kunnen generen van wat er aan de hand is op het gebied van brein en technologie in het algemeen (cultuur, levende technologie). Daar is dus wel behoefte aan. Sterker, er is een noodzaak toe (vereiste 3).

Om tot een *argument based psychology* te komen, is inzicht in de non-lineaire processen onontbeerlijk. In hoofdstuk 2 wordt hiertoe een dynamisch systeem perspectief gepresenteerd. Praktische consequenties worden daarvan afgeleid. Zo is bijvoorbeeld meer niet altijd beter, kent groei vaak niet een rechte lijn omhoog (zelfs soms episodes tijdelijk omlaag) en kennen veel processen een optimum. Echter, mensen denken in oorzaak-gevolg relaties. In de tekst passeren diverse (grappige) denkfouten die dit kan opleveren de revue. Om tot een echte argument gebaseerde praktische psychologie te kunnen komen, is het noodzakelijk een intuïtie voor het dynamisch systeem denken op te bouwen. Het lectoraat Brain & Technology houdt zich naast het exploreren van de geweldige mogelijkheden om met smart technologie de afstand te overbruggen tussen mensen en hun beperkingen, of juist mogelijkheden, vooral oók bezig met het komen tot dit verhaal. Naar een argument gebaseerde toegepaste psychologie!

Omdat het argument altijd de evidentie moet duiden en incorporeren, dient het argument altijd de basis te zijn bij het komen tot begrip, en om richtingen voor verdere ontwikkeling te tonen (vereiste 3). In de praktijk geldt tegenwoordig echter vaak dat evidentie verondersteld wordt voor zichzelf te spreken. Argument en ook discours (vereiste 4) blijven hierbij vaak achter. In deze lectorale rede wordt vooral stilgestaan bij de argument-vereiste, omdat juist het argument in de snel veranderende technologische ontwikkelingen vaak onvoldoende mee ontwikkelt en het argument zich bij uitstek

bevindt op het niveau van de toegepaste psychologie. Daarnaast vormt het ontbreken van argumentatie vaak de oorzaak van onvoldoende borging van de duurzaamheid (vereiste 1) en ongewenste blokkade van de psychologische ontwikkeling (vereiste 2).

In hoofdstuk 3 wordt de flexibiliteit van het biologisch systeem (de breincomponent) bekeken. Gesteld wordt dat de mens als het ware "ontworpen" is om met zeer veel verschillende technologieën en culturen om te gaan zonder daarvoor biologische (genetische) aanpassingen nodig te hebben. Culturele aanpassingen (technologie) maakten het relatief onbelangrijk dat het menselijk genoom erg smal is. Al 200.000 jaar dienen cultuur en techniek als een soort "schild" dat de mensheid beschermt tegen biologische veranderingen en daarmee ook tegen menselijke evolutie. Dit resulteert in een controverse: terwijl technologie en cultuur de noodzaak van evolutie hebben verminderd, is de impact van technologie op mensen kleiner dan zou worden verwacht op grond van het smalle genoom. Ook hier is sprake van een dynamisch systeem! Vereiste 1 en ook 2 worden hiermee relatief ondergeschikt aan 3 en 4. In hoofdstuk 4 wordt het menselijk rationeel denkvermogen nader beschouwd, en geconcludeerd dat denken volgens dynamische kaders zoals in hoofdstuk 2 zijn uitgewerkt, niet vanzelf gegeven is. Om tot goede argumentatie te komen, is dit echter wel noodzakelijk. Hoofdstuk 5, tenslotte, vormt een toepassing van vereiste 3 op de ons lectoraat project met autistisch toptalent in de context van mens en arbeid: Bèta talent Forward!

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