



## Paper PD05

# Career (and Life) Improvements Through Self-quantifying Biohacking Techniques

Sascha Ahrweiler, Bayer AG, Wuppertal, Germany

## ABSTRACT

Working as clinical data scientists comes with periods of high stress. More than once programmers need to pull all-nighters to prepare submission data packages or ensure rapid response. Unfortunately life does not get easier with career progression either. In our day jobs we support data driven decisions but often neglect this in our private life. We can follow the same principles to overcome consequences of stress-induced habits like lack of sleep, inactivity or other unhealthy habits. Tools for self-quantification and a 360 degree view on life can help to counter the stress related consequences and further improve career development. In this paper I will discuss structured approaches using self-quantifying techniques and biohacks for data driven life and career management.

## INTRODUCTION

In this paper, I will share some brief insights into the area of self-quantification and biohacking. Self-quantification provides deep insight into your own body. It helps to understand how your body reacts to certain inputs like nutrition and stress. Combined with a holistic understanding of the complex human body system, it can help you to improve your career and your life. Based on an example of a typical career of a Clinical Data Scientist, I will first define the terms of Self-Quantification and Biohacking. I will explain how life and career can be structured into six different areas to provide a holistic view and combine it with measurable outcomes. Each of these six areas will then be briefly touched in more details with an explanation, why this area matters, which variables are important to measure, how it can be measured and what can be done to improve. This paper can only provide a very brief insight though and focuses on the self-quantifying aspect.

**Disclaimer 1:** Self-quantification and biohacking is a very individual and personal topic. Therefore I will use the ego perspective throughout this paper. With that approach I hope to stress the fact, that this is my personal perspective. I do not intend to preach a perfect way to live, but would like to introduce you to some tools, which might enable you to find your own perfect way to live.

**Disclaimer 2:** The biohacking techniques I describe very briefly below are explained in more details in several books and papers. Most of these techniques are supported by personal experience and research papers, which are referred in these books. In order to enable an easier read of this paper, you will find all references and recommended readings at the end of the paper.

**Disclaimer 3:** This paper describes my own experience with self-quantifying biohacking methods and does by no means represent the opinion of my current employer Bayer AG, Wuppertal, Germany.

## A TYPICAL CAREER OF A CLINICAL DATA SCIENTIST

Let us start with a typical example of a career of a Clinical Data Scientist, by taking a look at the story of (fictitious) John. John is a manager of a very successful Clinical Data Scientist group in a big pharma company. John can look back to more than 20 years experience in the pharmaceutical industry. He successfully acted as statistical programmer on several FDA submissions. Each submission came with new challenges, but they all had in common that John had to work extra hours to meet the tight timelines and quickly react to regulatory agency questions. During these stressful times, John was fully focused on finalizing all his programs that he usually had to eat lunch at his desk to manage everything in due time. He also drank a lot of coffee and energy drinks to keep him awake during his several night sessions to finalize the agency package. After John turned into 35, he realized that he put on a couple of pounds too much on his waist, but he made a good salary already.



Thanks to his great work results, John quickly climbed the career ladder and now manages a global team of Clinical Data Scientist. Instead of working on a single submission, John is now accountable that his team delivers on time and in high quality for several global submissions. He spends now more time on an airplane than in his office. John is always on the run and checks e-mails until late at night. As a successful manager, John fully enjoys all the benefits of his position. He likes networking with his colleagues at the hotel bar, where they stay until late at night and with a lot of drinks to compensate their stressful work.

Since many years, John has challenges to fall asleep. His mind is busy with planning the next day and all the meetings he will need to lead. Recently it happened more than once that he exploded in staff meetings. If all his direct reports would show as much commitment as he did in his active programming years, his team wouldn't have the problems he observes on a daily basis.

Recently his doctor told him to take it a bit easier and watch his health. His blood pressure was way too high and he also shows pre-diabetes symptoms. His doctor prescribed tablets against that and also recommended some sleeping tablets. It seems that more than 20 years in such a stressful environment pay its tribute. John started to worry though a bit about the words from his doctor. He still has another 20 years to work before he can retire, but now that he takes his tablets, that should bring him back on track, right?

Admitted, the story from John was pure fiction combined with a lot of stereotypes. Every Clinical Data Scientist or manager probably has to cope with times of stress, unhealthy food and long working hours without a lot of activity. Working as Clinical Data Scientists we see a lot of advantages in gathering more data about patients. This allows us to get more insight into patients and their health challenges. We learn more about diseases and how these might affect their quality of life. What about our own health and quality of life though? Working as a clinical data scientist comes with phases of high stress. We often neglect to use approaches we successfully apply in our day jobs in our own life. Data driven approaches work as well on our own bodies to boost up performance in our private life and career. We can also personally benefit from state of the art medical research and new insights on human biology.

Today consumer devices like activity trackers and pulse meters produce a lot of data, which might not be as precise as state of the art medical devices, the data gathered can provide great insight into general trends though. This paper will provide examples of self-quantifying techniques and how they can help to keep control of your career and personal life by taking a holistic view.

## SELF-QUANTIFYING BIOHACKING

Sciences like biology, physics, chemistry and psychology all have their specific focus; life is a combination of all of these areas though. If we want to boost our performance and health, it is important to take a holistic view on everything what affects performance and health. The art and science of biohacking takes this holistic approach and combines everything. The aim of biohacking is to learn about those areas in life, which have an impact on health and performance and find methods to improve.

The term “biohacking” was added to the Merriam-Webster dictionary back in 2018 (reference <https://www.merriam-webster.com/dictionary/biohacking>). Best-selling author Dave Asprey, who is also known as the godfather of Biohacking, has prepared a more intuitive definition. In essence, biohacking is a series of N=1 experiments, which follow highly individual protocols. Biohacking takes a systematic approach on wellbeing and aims at understanding your own body and how it reacts with different kind of inputs.

### ***Biohacking (verb, noun):***

*(v): changing your environment from the inside-out so you have full control of your biology; using your body as your personal laboratory, finding the exact hacks that work for you.*

*(n) The art and science of becoming superhuman*

*Dave Asprey*

Source:

<https://www.bulletproof.com/diet/bulletproof-diet/bulletproof-for-beginners/>



**Quantified self (noun):**  
(n) *The practice of taking constant measurements about oneself, such as sleep patterns, food intake, steps taken every day, etc.*

The process of learning about those areas of improvement mentioned above can follow similar processes followed in clinical trials: before changing anything in a running system, an endpoint strategy should be defined. This strategy should define variables of interest and how to measure these variables. Technology has made great improvements in the recent years and provides gadgets for the consumer market. These gadgets allow humans to apply self-quantifying techniques, which can establish an unbiased feedback system. This paper focuses on self-quantification methods, which are mostly digital and can also be utilized to learn about data sciences and analytics.

**Disclaimer:** It is important to follow good experimentation practice when someone starts an N=1 experiment. There are tons of good and bad advises out there. Before introducing any change in your life, measure your baseline and measure your success on an ongoing basis. Also consult with your doctor if you experience any health issues.

It is impossible to provide a comprehensive insight into the complex human body in less than 15 pages. There are countless books and papers available to learn more details about metabolic pathways, body cells, the human microbiome, diets and various other biohacking topics. Many of the recommendations below are explained in more details in 'Biohacker's handbook' and in various books, blogs or podcasts by Dave Asprey. This paper focuses only on the self-quantifying methods to get better insights into your body.

## HOLISTIC VIEW ON LIFE AND CAREER

The endpoint strategy definition requires a holistic view on life and career. Similar to clinical trials, where we distinguish between Safety and Efficacy analysis, we could take a structured approach on this as well. German biohacker Maximilian Gotzler defines a structured approach by distinguishing six different areas of life, one can track and hack. These six areas are:

- Recovery
- Activity
- Nutrition
- Balance
- Focus
- Environment

It is important to keep in mind that these areas are far away from being independent. For example, the quality of your recovery during sleep is influenced by all of the other areas. You probably won't sleep well in a noisy bedroom after heaving a heavy meal. Examples of self-quantifying techniques, aligned with corresponding biohacks to improve performance measures for career and life, will be explained further below.



Figure 1 1 Six areas of LIFE taken from Maximilian Gotzler, Biohacking - Optimierte Dich selbst, 2018

## RECOVERY

Recovery is of utmost importance to human life. During sleep our body repairs itself on a cellular and psychological level. A healthy and good sleep is of critical importance for a great performance at work. There is plenty of evidence that sleep is important and that the body cannot function properly without enough sleep.

Unfortunately there are often conflicting and misleading messages and wrong interpretations of research results, how much sleep human's need. The accepted opinion is, that someone needs to sleep eight hours per night. Large-scale study results though debunk with this. A BMJ published study back in 2002 presented results of sleep habits from more than one million people over six years. The study outcome was that those subjects who slept six or seven

***“Tired minds don't plan well. Sleep first, plan later.”***  
- Walter Reisch



hours had a lower death rate than those who regularly slept eight or more hours—or less than four (see reference).

It would be foolish though to act now on these results and set your alarm clock earlier. Keep in mind that the study presents average results and does not give an action item for an individual. As a self-quantifying biohacker you will be able to measure your highly individual sleep habits and will have the right hacks.

#### VARIABLES HOW TO MEASURE RECOVERY

The following variables could be measured to get insights into the recovery of a human body:

- **Heart Rate Variability** - One variable, which is an important indicator of good and restful sleep, is the Heart Rate Variability (HRV). HRV is the variation among the intervals of your heart beats and is a useful indicator of several health-related issues. A healthy heart has slight variations between each heartbeat. A higher HRV can be interpreted as a sign for a well-recovered body.
- **Time of Sleep in each sleeping phase** - The total time of sleep is a variable, which is reasonable to measure. As mentioned above, humans should sleep between 6 to 8 hours to fully recover. In addition to the total sleep time, it is valuable to get insights into the different sleep phases. Basically sleep consists of three different phases:
  - *Light sleep* – During this phase, the heart rate slows and body temperature drops. The body is getting ready for deep sleep, but can still easily wake up due to any disturbances.
  - *Deep sleep* – During this phase, the body repairs and regrows tissues, builds bone and muscles and strengthens the immune system
  - *Rapid Eye Movement (REM) sleep* – During this phase, the dreams start and your brain is more active
- **Time to reach Resting Heart Rate** - The time it takes until your body is at full rest and you reach your resting heart rate is another useful indicator, how relaxed your body is. If your digestive system for example is busy with coping with a heavy meal and lots of alcohol, your resting heart rate will be increased and it will take longer to reach your resting heart rate.
- **Body Temperature** - A rise of body temperature during sleep can be a sign of inflammatory activities, which keeps your body active during your sleep. Measuring your body temperature while you sleep provides valuable insights into your overall health.
- **Room temperature and other environmental measures** - The human body recovers best in a cooler environment. Temperatures around 18 degrees Celsius are ideal for a healthy sleep. The humidity should be between 30 and 50 percent. Also the amount of light and noise in your bedroom should be kept at a minimum. Measuring all these variables could give valuable insights into your sleeping habits.

#### SELF-QUANTIFICATION EXAMPLES TO MEASURE VARIABLES

The following methods could be utilized to measure the above mentioned recovery variables:

- **Oura Ring** - The Oura Ring is a sleep tracker, which can be used as a general activity tracking device as well. This is a ring, which is available in different ring sizes and styles. It can be worn at any finger and gives valuable insights into all variables mentioned above. In addition to that, the Oura ring calibrates to each individual user and provides optimal sleeping times based on observed patterns. It also provides a composite score called “Readiness”, which is a score between 1 (lowest readiness) and 100 (best readiness). The Oura ring connects via Bluetooth to the Oura app, which is available for iOS or Android devices. Besides data insights available on mobile apps, Oura also offers a cloud based data insights and visual analytics platform.
- **Beddit** - The Beddit tool is an external sleeping tracker. Sensors are attached to the mattress and measure sleeping behaviour as well as heart rate, snoring, breathing, and room temperature.
- **Dreem 2** - The Dreem 2 is a kind of headband, which also includes some kind of headphones. Dreem2 measures your brain activity, heart rate and movements during sleep. It also supports you in falling asleep with audio features and sends bursts of pink noise while you sleep to strengthen your deep sleep.
- **Sleep trackers in activity trackers** - Other self-quantifying devices, like various activity trackers, such as watches from Garmin, Fitbit or Apple, are able to track your sleep as well. These devices are not specialized for this purposes though. Therefore the insights should be taken with a grain of salt.



## BIOHACKING METHODS TO INCREASE RECOVERY

There are numerous options how to increase recovery or sleeping times. Several sleep improving hacks can be found in the reference material. In summary, the following high level hacks might help in the beginning to improve sleep:

- Nutrition has a big impact on the quality of sleep. Avoid eating two hours before you go to bed. Supplements like Magnesium often help to fall asleep and help the body to recover.
- Regular activity for about 20 minutes a day help to improve sleep. Avoid working out 2 hours before bedtime though.
- Setup a healthy environment in your bedroom. Snake plants help to provide oxygen and take care of the humidity. Avoid blue light sources such as computer or TV screens in your bedroom. Use blue light blocking glasses in the evening to counter the negative effects of blue light on the melatonin production.
- Give your mind some rest from a stressful day and try to get in Balance. Regular meditation helps with stress relief and helps to clean your mind from negative thoughts especially prior to bedtime

## ACTIVITY

The importance of activities on well being and health was already known in Ancient Greece. Hippocrates (460–270 BCE) has been quoted: “Eating alone is not enough for health, there must also be exercise.”. Especially when sitting in front of a computer the whole day, extra efforts have to be taken to stay fit and active. Regular and the right activities help to keep your cardiovascular, respiratory and metabolic systems intact.

*“Physical fitness is not only one of the most important keys to a healthy body, it is the basis of dynamic and creative intellectual activity.”*

- John F Kennedy

## VARIABLES TO MEASURE ACTIVITY

The main variables to assess your individual physical performance measure the energy production in aerobic and anaerobic processes as well as your ability to recover from exercises. Other areas like neuromuscular function or mobility are important as well, but are also more complex to measure and therefore are out of focus for this paper.

- **VO2max** - Maximal oxygen uptake (VO2 max) refers to the oxygen uptake occurring under extreme stress. It describes the ability of the respiratory and circulatory system to deliver oxygen and the ability of your muscles to use it for energy production. Maximal oxygen uptake is commonly expressed as a relative value of liters per minute per kilogram of bodyweight (ml/kg/min). Higher VO2max values are associated with a better endurance fitness which can be improved with regular endurance or interval training.
- **Test results from anaerobic fitness tests** - There are various tests, which you could use to measure your anaerobic fitness. For example, the time required to row 2.000m is a great variable to measure your anaerobic fitness. During this test you will need to utilize your maximum power for an extended time. Functional threshold power for cyclist or lactate threshold power for runners, also provide you with a number, which you could use to assess your anaerobic fitness.
- **Heart Rate Variability** - HRV has already been explained further above. HRV also provides a good insight into how quickly your body can recover from stressful exercises.
- **Daily activity** - You should choose some simple variables to measure your daily activities. A simple variable like the amount of steps per day, activity time or miles cycled per day provide you a good insight and might motivate you to move more in case you have not reached your daily or weekly goals.

## SELF QUANTIFYING METHODS HOW TO IMPROVE ACTIVITY

The following methods can be used to self-quantify your activities:

- **Activity trackers** – activity trackers, such as a Fitbit or an Apple Watch provide great tools to measure your daily and weekly activities. Depending on the model, These activity trackers also measure heart rate and provide good insight into your overall fitness.
- **Garmin sports watch** - If you want to become serious about your activity and fitness, an investment in a Garmin Sports watch is a reasonable one. Various models provide you with fitness tests as described above. If you are a runner or own a bike with a powermeter, you can measure your VO2max level as well as



your aerobic and anaerobic fitness. Some Garmin models also use HRV measurement to give you feedback how long you should rest prior to your next workout to prevent overtraining.

#### BIOHACKING METHODS TO IMPROVE ACTIVITY LEVELS

There are numerous options how to increase your own activity.

- It is a great start to track your activities to get an idea how active you are actually over a usual day. That alone helps to increase awareness and can be a wake up call for yourself.
- The most important hack though is to pick an activity, which fits best into your life. You don't need to become a marathon runner to see positive effects on health. But if you like to run, go for it (pun intended)! However, adjust your activity plans to your current activity levels. The above mentioned activity trackers often help you to get motivated and started. Remember that biohacking is about getting to know your body. It is a good idea to keep your activity variables on your radar and adjust your trainings accordingly.
- Set yourself challenges, like for example meeting daily step or weekly cycling miles. Virtual competitions with friends or colleagues help you to stay motivated and to go the extra mile. Tracking these activities with apps like Strava also show you how you improve over time.
- If you manage a group of people, why not creating a challenge for your entire group? Help them to stay fit as well and lead by example. Almost all activity trackers allow the creation of group challenges.
- A combination of strength and endurance training provides the best overall benefit to your body. Rowing provides a good compromise here as it improves both endurance and strength.
- High intense interval trainings (HIIT) are exhaustive, but especially if you don't want to invest a lot of time, they might be the best fit for you. Tabata trainings for example only require a time commitment of 4 minutes.
- Finally, although challenging to measure, but you should not forget your mobility. Activities like Yoga also provide great opportunities to stay mobile and also become stronger.

#### NUTRITION

In the introduction, I already provided examples of stressful situations for data scientists. Often, these stressful times come along with following unhealthy diets. Especially when we are stressed, our will power tends to go down. This often results in bad food choices like sweets or salty snacks. Another challenging situation is travelling. When you are on the road, eating becomes more challenging and often results into overeating as well. And then there are of course these unhealthy snacks in meetings.

There are countless diets available. They all have one in common, they only fit to a certain populations and do not take the individual into account. Most diets often aim to reduce certain variables, like the amount of carbohydrate, protein or fat intake, or they might reduce the overall calorie consumption. You might want to believe in a low-fat-high-protein, or a low-carb-high-protein, or a low-carb-high-fat diet, but until you get reliable measures, you need to follow a trial-and-error approach to test, which diet fits best for you.

*“Let food be thy  
medicine.”*  
- Hippocrates

#### VARIABLES AND SELF-QUANTIFICATION TECHNIQUES TO MEASURE YOUR NUTRITION

Until recently, the only measures to assess the success of your diet was a weight scale and maybe the circumference of your hip, belly and waist. In the meantime, there are more advanced and personalized measurements available, which help you to get a better insight into your metabolism and genomic predisposition related to food.

- **Gene Testing** - Genes define the biochemical pathways in your body. With that, your genes also define how you digest food and produce energy out of food. For example, around one third of humans have a variation of the MTHFR gene, which has an impact on the way we handle folic acid. Folic acid can be found in vitamin supplements and processed foods. Individuals with the MTHFR variation cannot efficiently convert folic acid into active folate, which results into high homocystein levels. For these individuals it is important to switch from folic acid to methylfolate to better support their bodies.

It is important to understand that life style choices affect your genes. Epigenetics (the activation or deactivation of genes by factors external to the genome) can be perceived for example in the increased or decreased function of certain genes due to environmental factors such as diet.

Consumer grade tests from 23andme or AncestryDNA also deliver DNA raw data, which can be used on various platforms to find out more about yourself. The platform [www.promotease.com](http://www.promotease.com) allows upload of



DNA raw data and provide detailed reports on current research papers linked to your specific genes. The platform SeekingHealth also allows the upload of DNA raw data and gives insights into various biochemical pathways and how your specific gene variations might affect them. These insights help to understand how your body reacts to certain food.

- **Microbiome** - The human microbiome refers to the collection of all the microorganisms. These bacteria live for example on your skin, in your mouth and in your intestine. The functions of these bacteria is for example to break down your food into digestible pieces for your body. The availability and conditions of these bacteria has a significant influence on your energy production and contributes to your vitamin levels as well. Some bacteria might explain why you are digest carbohydrates way more efficiently than other nutrients.

The human microbiome is highly individual and therefore should be measured to understand your optimal nutritional needs. Antibiotics and the food you eat affect the bacteria in your intestine though.

- **Food tracking** - If you want to get a better insight into how your body reacts to your food choices, you should track your daily food intake. The more precise you track, the better the insight will be. Beyond your macronutrients (ie. fat, carbohydrates and protein you could also track your micronutrients (eg. iron, magnesium, vitamins, etc.).

Apps like MyFitnessPal or Noom provide daily food diaries, which help you to better understand your body. A simple weight scale, or a more sophisticated smart scale will provide you with the numbers for your self-quantification experiments.

- **Blood glucose meter** - High peaks and troughs in blood sugar can lead to sugar cravings and can also lead to gaps in performance. Blood glucose meter provide valuable insights into which nutrients might have a negative effect on your blood sugar. If you follow a ketogenic diet, a keto meter will also provide you with the amount of ketones in your blood, breath or urine.

There are several blood glucose meters on the market. They usually require a small amount of blood to provide you with a single number for your blood glucose levels. Abbott also provides a device, which measures your glucose levels 24/7 for about two weeks in 3 minute intervals. A comparable, but more expensive and more exact 24/7 meter is the Dexcom device.

#### BIOHACKING METHODS TO IMPROVE YOUR NUTRITION

There are countless books, podcasts, trainings, and other opinions about nutrition available.

- The most important hack is to be confident enough to find your own way to nutrition and food. Each diet has its pros and cons, but most diets are not sustainable as they reduce certain elements of food.
- Get to know your body and measure how your body reacts over a longer period of time on your food choices. Each diet will show success in the beginning.
- A great read especially for improved brain performance is „Head Strong“ and „The bulletproof diet“ from Dave Asprey. The author provides several nutritional hacks how food can improve your brain performance.
- Based on the results from your above mentioned microbiome and gene measurements, you will be able to find the best diet for yourself. Blogs from biohackers will provide you with helpful tips what certain foods do. Find the right diet for yourself. Do not follow the general advises, which work for the general public. Try several things like intermittent fasting or Ketogenic Diet (LCHF) or start your day with a Bulletproof Coffee.

#### BALANCE

When writing about balance, I do that with a primary focus on the human brain and your mind. Especially in a stressful job it is of critical relevance to find a good balance between keeping your mind busy and putting your mind in a calm state. Your body needs a rest after an exhaustive training and likewise your mind needs to have a break as well. We way to often flood our brain with a never ending stream of information even after work. Be it any news on our social media channels, the most recent Netflix show, the news in TV or simply browsing websites, we keep our brains busy 24/7.

In contrast to animal brains, the human brain is able to think in an abstract manner. This enables us to think about abstract topics like CDISC data

*“If we want to save the world, we must have a plan. But no plan will work unless we meditate.”*  
- Dalai Lama



models or statistical models. This comes with positive and negative effects. While statistical modeling might be a great work to keep your mind busy with factual work, there are several pitfalls in our human way of thinking when it comes to processing information. This is especially important in the area of communication. The model that communication always requires a sender and a receiver has been discussed several times. We often neglect that model also when we think about non-verbal or non-written communication. Our brains often start to draw conclusions based on information, which may or may not be the right conclusion. Especially for people managers this becomes a challenge. Way too often situations get escalated, which are caused by simple misunderstandings or where we drew wrong conclusions based on behaviours from others. A famous quote from Eckhard Tolle states, that the primary cause of unhappiness is never the situation buty your thoughts about it.

Regular meditation is a very powerful tool to address both above mentioned challenges. Meditation helps to give your brain a break and put it in a calm state. Meditation even more helps to learn how to take a step back and learn to observe whenever your brain tries to trick you with wrong stories. It helps to stay calm in challenging and stressful situations.

#### VARIABLES TO MEASURE BALANCE

Measuring your balance is closely aligned with measuring your brain activity, the way how your body reacts to stressful situations and time spend for meditation. The following variables are reasonable to track for a self-quantifying biohacker:

- **Moments of mindfulness** - as stated above, regular meditation is a powerful tool in many aspects. Tracking how often and how regular reach moments of mindfulness and a calm state is a good indicator how balanced your mind is.
- **Heart Rate Variability** - Again,HRV is great variable, which gives feedback on your own balance. In times of stress - regardless if physical or mental stress - your HRV will be lower than in relaxing moments.
- **Brain waves on EEG** - Depending on your state of mind, certain brain waves are more dominant than others. During a state of high concentration - like coding activities - your brain primarily produces theta waves. During moments of calm and mindfulness, your brain has dominant alpha waves. Measuring your brain waves is a powerful variable to measure your balance.

#### SELF QUANTIFYING TECHNIQUES TO MEASURE YOUR BALANCE

There are some consumer grade technologies available, which help to measure the above mentioned variables.

- **Muse Headband** - this headband is a great tool to learn meditation with real time feedback. Basically, the headband consists of sensors, which measure your EEG. In the accompanied app, the user gets weather based real time feedback on his or her state of mind. The user hears stormy weather when his or her mind is busy. Birds start to tweet when reaching a state of calmness. At the end of each session, the user gets a summary of time in calm state and also gets a visual display of the measured EEG.
- **Muse monitor app** - The above mentioned Muse headband offers an open API, which allows other apps like Muse Monitor to measure normal EEGs as well. You can use this app with the headband to measure your brain activity during a normal work day as well.
- **Meditation Apps** - Meditation apps like Calm or Headspace help to learn meditation through guided meditation techniques. These apps do not measure your brain activity like the above mentioned Muse Headband, but the time spend on meditation activities is also a valuable variable to check the amount and regularity of meditation activities.
- **Apple Watch Mindfulness** - similar to meditation apps, the Apple Watch also has a pre-installed app, called mindfulness. The app provides help to focus on breathing via vibration and measures the time spend on th
- Is exercise.

#### BIOHACKING METHODS TO IMPROVE YOUR BALANCE

Getting control over your mind can be achieved with various biohacking methods.

- **Morning Routines** - start creating a regular morning routine, which includes moments of meditation ideally prior to consuming the first cup of coffee or tea.
- **Gratitude Journal** - start writing a gratitude journal like the 5-minute journal. Especially in stressful times we tend to have a more negative attitude. With practicing gratitude on a regular basis you will see things more positively. Starting your day with positive thoughts is second to none to ensure a good balance.
- **Build in moments of mindfulness in your day** - practicing mindfulness in the morning helps to have a great start in the day. Including a short meditation session at lunch time helps to stay focused for the rest of your work day.
- **Focus on the moment** - our minds keep us busy with worrying about the past or the future. We often neglect the current moment though. Learning to seize the moment helps to focus on current activities and stop worrying about issues, which may or may not come in the future



## Focus

Focus on a particular task or on a special goal is one of the key skills of a Clinical Data Scientist. It is challenging though to not get distracted and ruthlessly follow your goals. In an constantly changing technical environment it is very easy to loose focus and get distracted to other things such as e-mails, social media channels or any other activity, which do not lead to your goal.

A mandatory first step in reaching your goal is of course to know exactly what your goal is. When you work as a Clinical Data Scientist, I assume that working with data and achieving insights is the work you love to do and that you are really passionate about. If that statement does not relate to you, you might consider to change your job and find your fulfillment in a job, which is worth waking up every morning.

As a second step it is important to further define a more specific goal, which is important to you. For example, you want to become better in coding, learn a new programming language, deliver the complete statistical programming package for a submission, or deliver a new technical solution to your team. In any case it is important to formulate your goal following the SMART principle. The M in the SMART definition of goals stands for measureable, so it should be easy to track your progress of achieving your goal.

*“Realize deeply that the present moment is all you ever have. Make the Now the primary focus in life.”*  
- Eckhart Tolle

### VARIABLES TO MEASURE FOCUS

Assuming you have followed the recommendations above, to formulate your goals following the SMART principle, the most reasonable variables are the following:

- **Time spent on achieving (daily) goal** - when your goals are defined in a measureable manner, you should be able to reach your goal by continuously spending the majority of your available time. Time spend on this goal therefore is reasonable to track your progress
- **Time spent on other things** - if you know your goal, you also know when you are not focused on a specific goal. Spending time on social media is such a distraction, which is probably not helping to achieve your goal. Unless of course you work for Facebook, Instagram, LinkedIn or any other social media company.

### SELF-QUANTIFICATION METHOD TO IMPROVE FOCUS

There are several digital helpers on the market, which might help improving your focus on your specific goals:

- **Rescue Time app** - Rescue time is an app, which measures your productivity on your computer. At the end of the day or each week, you will get summary statistics of all the applications you used over the day. This app requires administrator rights though to install, which is usually a roadblock in a corporate technical environment.
- **Screen time app** - this iPhone app provides feedback how much time you have used on various phone applications. This also provides reasonable insights especially when it comes to reducing time on social media. You can even set a maximum amount of time for certain apps, which also helps staying focused.
- **Pomodoro apps** - the pomodoro technique is based on the philosophy, that it is easier to stay focused for a limited amount of time (ie. 25 minutes) followed by a short time of distraction (ie. 5min) before you start again another 25 minute deep focus session. Pomodoro apps are useful to divide your (working) day in 30 minutes intervals.
- **Pavlok** - A rather drastical solution is the Pavlok band. The Pavlok armband provides light electroshocks whenever the user gets distracted by a predefined topic. These electroshocks definitely help to stay focused on avoiding these distractions.

### BIOHACKING METHODS TO IMPROVE FOCUS

Valuable methods to improve your focus are the following ones:

- Knowing exactly what you want and following these goals ruthlessly is definitely the most important hack. Once you have defined your goal as specific as possible, you should further define it in more tangible and achievable sub-goals.
- Start with thy Why. Put your goals in context of why you are doing what you are doing. It makes a huge difference when your know why you are doing things. Does your goal have a bigger meaning, which is the reason why you are waking up? For example, working as a Clinical Data Scientist could mean that you want to support finding novel solutions to help patients with serious diseases.
- Visualize your goals. If you can picture yourself how success looks like when you reach your goal, this helps to continuously move towards the right direction. When your goal is too abstract to visualize, you could also connect



your goal with a reward for yourself. Visualizing the moment, when you reward yourself after reaching your goal is very powerful as well.

- Start writing to-do lists and prioritized tasks appropriately to achieve your goals. This works great with daily gratitude journals, where you plan your day in the morning or revisit what you have done during the day.
- Include daily or at least weekly check-ins with yourself. How much time have you worked on your goals? Daily or weekly check-ins help you staying focused or adjust your to-do lists for the next days and weeks.
- When working on a specific tasks, binaural beats, which you listen to with headphones, support the brain to reach a state of focus. As discussed in the section about Balance, your brain produces different waves with different activities. A focused brain has dominant theta waves. Binaural beats produce frequencies in that exact theta wave frequency, but with slight difference on the left and right speaker of your headphones. Your brain tries to balance this difference and as a result your brain adapts to the exact same brain wave as required for focused work.

## ENVIRONMENT

The last area in our holistic approach to life focuses on environment. Each activity we do takes place in a certain environment. The environment where we do certain activities has a significant impact on how well or how bad we do these activities. For example, everyone would agree that it is quite challenging to work on an internet project if we are in a location without access to internet. Same rules apply to our human body and especially the human brain. We can setup our environment in such a way that we can support our body and brain to reach its highest performance level.

*“The environment shapes people’s actions.”*  
- B F Skinner

This last section is of course closely connected to the earlier paragraphs. Every step we take, every breath we take, takes place in an environment. We usually sleep in a bedroom, usually work in an office and we usually workout in a gym or outdoors. The environment, where we do these activities may or may not support how we are doing these things.

### VARIABLES TO MEASURE THE ENVIRONMENT

The following variables are reasonable to understand how the environment affects your performance:

- **Location** - when we talk about environment, location is a primary variable we should track. At each time our body is in a well defined area. The location can be as specific as a certain GPS location or could also be described in more general as a description where we are (eg. office, plane, hotel room, etc.)
- **Temperature** - the environment where we are, has a certain temperatures. Each activity has a temperature, which might support your performance. For example, running a marathon at 20 degrees Celsius is probably easier compared to a temperature of about 40 degrees Celsius.
- **Humidity** - similar to temperature, each environment has a certain humidity. Again, each activity is impacted by the humidity.
- **Light** - the intensity, brightness and also kind of light (eg. natural daylight or LED light) has an impact on our performance as well. The primary reason for this is the circadian rhythm, which regulates our human body. Light has a major impact on the circadian rhythm, since light exposure suppresses the secretion of melatonin and disrupts the circadian rhythm.

### SELF QUANTIFICATION METHODS TO MEASURE ENVIRONMENTAL PARAMETERS

The following methods to track the environmental variables:

- **GPS tracker** - today nearly every smartphone comes with an onboard GPS tracker. Apps like Gyroscope, which will be mentioned further below, are able to track your GPS location on an ongoing basis.
- **Smart Sensors** - sensors like the Netatmo Smart Home measure the above mentioned variables humidity, noise level, temperature and also air quality. They warn you in case certain pre-defined values are reached.
- **Smart lightning systems** - smart lightning systems like Philips Hue can be setup in such a way that the light in your home or office adjusts to the time of the day.

### BIOHACKING METHODS TO ENSURE YOUR ENVIRONMENT IS SETUP TO SUPPORT YOUR PERFORMANCE

Since everything we do takes place in a certain environment, there are countless methods for the best environmental setting. Therefore I only focus on the most important environmental hacks for this paper in the professional development stream, which is sleep and office settings.

The most important biohacks related to your sleep environment are the following:



- The ideal temperature for a restful sleep is between 18 and 22 degrees Celsius. The ideal humidity in your bedroom should be between 30% to 50%. Snake plants in your bedroom help to regulate humidity and also filter the air.
- A totally blacked out room is the best setup for a healthy sleep. Even LED lights, eg. from an alarm clock, provide unnecessary light, which might disturb sleep. If you cannot turn off these light sources, consider using black tape especially when you travel.
- Avoid any artificial blue light especially after sunset. LED lamps might be very cost efficient, but they usually produce quite a lot of blue light. Blue light suppresses the production of melatonin, which is also known as the sleep hormone. Consider installing LED lamps, which can change the light spectrum. If you set the light to a warmer (ie. red) tone after sunset, you support the production of melatonin and help your body to prepare for sleep. On the other hand, if you want to activate your body in the morning, exposure to blue light helps to wake your body up.
- Due to the same reason, you should ban digital screen (eg. laptop, TV screen, phone) out of your bedroom. They produce a huge portion of blue light as well. Apps like f.lux or the Apple build in night-shift can be setup in a way that screen automatically shift to warmer light. If you want to look really nerdy, you can even put on special blue light blocking glasses after sunset.
- Certain fragrances, like lavender or stone pine help your body to relax and are often used against sleep disorders.

The most important biohacks related to your work environment are the following:

- The ideal temperature in your office is between 20 to 22 degrees Celsius with a humidity between 40 to 60%. Again, plants help to regulate the ideal humidity in your office. Alternatively a humidifier might help to regulate the humidity if the usual humidity is way too low in your office.
- Certain fragrances stimulate the left side of your brain, which is responsible for analytical and structured thinking. For example, lemongrass, eucalyptus, or mint fragrances have a performance stimulating effect and activate the left side of our brain.
- Noise cancelling headphones help you to focus on your tasks especially if you work in an open office. If you combine them with the above mentioned binaural-beats you have the perfect setup to fully focus on your projects.

## ONE MORE THING...

So far I have discussed the six different areas as a holistic view on life. As mentioned a couple of times already, all these areas are connected. Nutrition, activity, balance and environment have an impact on your sleep. Sleep impacts your ability to focus and balance. You can find any permutation of the six areas and will always find areas, which impact each other. Therefore it is important to not solely focus on one area. Rather try to find the best balance between all these areas.

Unfortunately I am not aware of any app or Programm, which provides a full overview about all these variables, which I mentioned above. There are however a few apps, which come pretty close to a complete dashboard:

- **Gyroscope** – Gyroscope is a life tracking app and web-dashboard. It provides a good overview about various health parameters, activity times, mindfulness moments, your geo locations. It tracks your mood trackers and also offers visual analytical tools and creates various reports, such as annual summaries. You can also export all your data and do more sophisticated statistical analysis with R or SAS(R).
- **HeadsUp Health** – HeadsUp Health is the only app I'm aware of, which allows tracking of laboratory results or medical treatments. It connects to quite a lot of other self-tracking devices and helps you to get valuable insights into trends. It allows the user to analyse all paramters with visual analytics tools. HeadsUpHealth also provides the feature of data export for more detailed statistical analysis.
- **Apple Health** – The built-in Health app also connects to quite a lot of self-quantifying gadgets. Different lifestyle parameters can be displayed to search for daily, weekly or yearly trends. It does not allow to correlate different parameters though. But data export for data analysis with other tools is possible. Unfortunately it is also only available on iphones and not on other Apple devices.

## CONCLUSION

Combining data about your body with understanding how your body reacts, can help to improve all areas, which have an impact on your performance. I have presented a holistic approach on life, which provided recommendations and solutions for the six areas of life:

- Tracking your sleep with a gadget like the Oura ring will provide you with actionable recommendations to improve your sleep.
- Tracking your daily activities create awareness if you are active enough to maintain a healthy body.
- The impact of nutrition on your performance is critical. Understanding how your body digests your food for example with a microbiome tests, provides valuable recommendations for your individual diet.

- Finding the right balance for your mind and body is key to a good long-term performance. Meditation is a powerful tool to find the right balance and stay calm in stressful situations.
- Focus on the things, which matter to you and measure the progress on an ongoing basis. Knowing what you want to achieve is a mandatory requirement.
- Where you work, sleep and do other things has an impact how you work, sleep and do other things. Measuring your environmental parameters help to adjust them if necessary.

In essence, self-quantification is a powerful tool for me to get to know my body and understand how various habits define my life style. Tracking is one thing, the more important thing though is to act on your measurements. Tracking and acting will help you as well to improve your life and also your career.

## REFERENCES AND RECOMMENDED READINGS

### ***Self-quantifying Biohacking***

Biohacker's Handbook – Upgrade yourself and unleash your inner potential, Sovijärvi O, Arina T, Halmetoja J, 2018, ISBN 978-952-7241-09-7, <https://biohackingbook.com>, last checked October 3rd 2019

Biohacking - Optimiere dich selbst, Gotzler M, 2018, ISBN 978-3-7423-0102-4

Game Changers – What Leaders, Innovators, and Mavericks do to win at life, Asprey D, 2018, ISBN-13: 978-0062652447

### ***Recovery***

People who sleep 7 hours a night live longest, Spurgeon D, [BMJ](#). 2002 Feb 23; 324(7335): 446, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1172056/>, last checked: October 3<sup>rd</sup> 2019

Oura-Ring sleep tracker: [www.ouraring.com](http://www.ouraring.com), last checked: October 3rd 2019

Beddit sleep monitor: [www.beddit.com](http://www.beddit.com), last checked: October 3rd 2019

Dreem 2 sleep headband: [www.dreem.com/dreem2](http://www.dreem.com/dreem2), last checked: October 3rd 2019

### ***Activity***

Garmin Sport Watches: [www.garmin.com/en-GB/](http://www.garmin.com/en-GB/), last checked: October 3rd 2019

Apple Watch: [www.apple.com/watch/](http://www.apple.com/watch/), last checked: October 3rd 2019

Fitbit Activity trackers: [www.fitbit.com](http://www.fitbit.com), last checked: October 3rd 2019

### ***Nutrition***

23andme gene testing: [www.23andme.com](http://www.23andme.com), last checked: October 3rd 2019

Ancestry DNA: [www.ancestry.com](http://www.ancestry.com), last checked: October 3rd 2019

StrateGene: [www.seekinghealth.com](http://www.seekinghealth.com), last checked: October 3rd 2019

Dirty Genes: A Breakthrough Program to Treat the Root Cause of Illness and Optimize Your Health, Lynch B, 2018, ISBN-13: 978-0062698148

Microbiome testing: [www.viome.com](http://www.viome.com), last checked: October 3rd 2019

MyFitnessPal food tracker: [www.myfitnesspal.com](http://www.myfitnesspal.com) , last checked: October 3rd 2019

Noom food tracker: [www.noom.com](http://www.noom.com), last checked: October 3rd 2019

Abbott Freestyle 24/7 blood glucose meter: <https://freestylediabetes.co.uk>, last checked October 3rd 2019

Dexcom continuous glucose monitoring: <https://www.dexcom.com/en-GB>, last checked October 3rd 2019

Head Strong: The Bulletproof Plan to Activate Untapped Brain Energy to Work Smarter and Think Faster - in Just Two Weeks, Asprey D, 2017, ISBN-13: 978-0062652416

## **Balance**

Muse Headband: [www.choosemuse.com](http://www.choosemuse.com), last checked October 3rd 2019

Stress Less, Accomplish More: Meditation for Extraordinary Performance, Fletcher E, 2019, ISBN-13: 978-0062747501

Calm Meditation app: [www.calm.com](http://www.calm.com), last checked October 3rd 2019

Headspace Meditation app: [www.headspace.com](http://www.headspace.com), last checked October 2019

The Miracle Morning: The 6 Habits that Will Transform Your Life Before 8 a.m., Elrod H, 2017, ISBN-13: 978-1473668942

5 minute gratitude journal: <https://www.intelligentchange.com>, last checked October 3rd 2019

## **Focus**

SMART goals: [https://en.wikipedia.org/wiki/SMART\\_criteria](https://en.wikipedia.org/wiki/SMART_criteria)

Rescue time app: [www.rescuetime.com](http://www.rescuetime.com), last checked October 3<sup>rd</sup> 2019

Focus Keeper Pomodoro technique app: <https://apps.apple.com/de/app/focus-keeper-pro-manage-time/id830466924>, last checked October 3<sup>rd</sup> 2019

Pavlok habit changing band – [www.pavlok.com](http://www.pavlok.com), last checked October 3<sup>rd</sup> 2019

Brainwave Binaural Beats app: <https://apps.apple.com/de/app/brain-wave-35-binaural-series/id307219387>, last checked October 3<sup>rd</sup> 2019

## **Environment**

Gyroscope – Track your Life and Improve your Health app: <https://gyrosco.pe>

Netatmo Weather station: <https://www.netatmo.com/de-de/weather/weatherstation>, last checked October 3<sup>rd</sup> 2019

Philips Hue smart lighting: <https://www2.meethue.com>, last checked October 3<sup>rd</sup> 2019

## **CONTACT INFORMATION**

Your comments and questions are valued and encouraged. Contact the author at:

Sascha Ahrweiler

Bayer AG

Aprather Weg 18a



10th–13th November  
RAI Amsterdam  
The Netherlands

# EU 2019

The Clinical Data  
Science Conference



42113 Wuppertal, Germany  
Work Phone: +49-202-36-5323  
Email: [Sascha.Ahrweiler@bayer.com](mailto:Sascha.Ahrweiler@bayer.com)  
Web: [www.bayer.com](http://www.bayer.com)

Brand and product names are trademarks of their respective companies.