

The Science of Setting & Achieving Goals | Huberman Lab Podcast #55

In this episode, I discuss the science of setting, assessing, and pursuing goals. I explain the neural (brain) circuits that underlie goal setting and pursuit. Then I describe nine science-supported tools anyone can apply toward their goals. I explain when and how to use goal visualization, when to use multitasking and how to use specific rewards to improve the likelihood of reaching your goals. I also explain why envisioning failures and their consequences are effective and how to set goals of the appropriate level of challenge. I also explain how the molecule dopamine is used to gauge our progress toward milestones and long-term overarching goals and how to leverage dopamine for goal pursuit. Finally, I explain a unique tool called 'space-time bridging' that can be used to support all aspects of goal setting, assessment, and pursuit. This episode ought to be useful for anyone seeking to improve their performance in work, school, exercise, athletics, or personal development.

#HubermanLab #Goals #Neuroscience

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Links:

The 85% Rule for Optimal Learning - <https://www.nature.com/articles/s41467-019-12552-4>

Effects of Narrowing Visual Attention on Goal Pursuit Behavior - <https://journals.sagepub.com/doi/10.1177/0146167219861438>

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- Welcome to the Huberman Lab Podcast, where we discuss science and science-based tools for everyday life. I'm Andrew Huberman, and I'm a Professor of Neurobiology and Ophthalmology at Stanford School of Medicine. Today, we're talking all about goals and the science of goal setting and achieving your goals. There's a tremendous amount of information on the internet and in books and so forth, about how to set goals and assess your progress towards goals and update your goals and so forth. In fact, there are so many programs out there, that includes so many different acronyms that it can be a little bit overwhelming. Today's conversation about goals, is going to be quite a bit different. Indeed, we are going to talk about setting goals. We are also going to talk about how to assess progress towards goals. And we are going to talk about goal execution. However, we're going to do all of this in the context of neuroscience, because it turns out that there are not hundreds or dozens or even several neural circuits in your brain, that control goal setting and movement toward your goals. There is one and while it includes many different brain areas, that one circuit is the same circuit, that's responsible for pursuing all goals. And it relates to some very basic neurochemical mechanisms that are understood. So while there's a wealth of information out there about goals and goal setting and goal achievement and so forth, there's comparatively little information that's been available to the public about the neuroscience of goal setting and goal achievement. So that's what we're going to focus on today. I promise that we're going to get into the neuroscience, we're going to touch on a little bit of the psychology and how the neuroscience relates to what's known in the psychology literature. And we are going to establish several, in fact, four specific protocols that you can use for goal setting,

00:01:56 Tool 1: Learn Fast(er) by the 85% Rule

goal assessment and goal execution in an ongoing basis, regardless of what your

personal goals happen to be. Before we dive into our conversation about goals and goal setting and goal achievement, I'd like to highlight some recent scientific findings, that I think are going to be interesting and actionable for many of you out there. In earlier podcasts, we talked about neuro-plasticity, which is the brain's ability to change in response to experience. In fact, neuroplasticity underlies all forms of learning, whether or not it's language learning or learning music or math or a physical skill, all forms of learning involve the reorganization of connections in the nervous system, the brain and spinal cord and body. One of the key principles of neuroplasticity, is this notion of making errors as a good thing toward neuroplasticity. It is a little bit counterintuitive, but what the scientific literature tells us, is that whenever we're trying to learn something new, if we make an error, we know it feels frustrating, but that state of frustration, actually queues up particular brain areas to be more alert, so that on subsequent attempts to learn that thing, we have a heightened level of focus and a higher probability of learning the new skill, regardless of what that skill is. And I've talked about this before in various episodes, as encouraging people to embrace errors or pursue errors, not as their own end goal, but errors as an entry point for making the brain more plastic. And if you think about it really makes sense, why would the brain change at all, if it's performing everything perfectly? When you make errors, well in the immediate seconds and minutes after those errors, you are in a better position to learn. A common question I get, however, is what should be the rate of errors? Which is really just a way of saying, how hard should the given task be that you're trying to learn or perform? And it turns out there's an answer. There's a recent paper that was published in a great journal, "Nature Communications". This is a paper, our last author, Jonathan Cohen, and the paper is entitled, "The Eighty Five Percent Rule for optimal learning". This paper, we will make available by a link in the show note captions, but basically what this paper shows, is that when trying to learn something new, you want to make the difficulty of what you're trying to learn, such that, you are getting things right about 85% of the time. That you're making errors about 15% of the time. And the reason I like this paper, is it really points specifically to some protocols that we can implement because people always say, okay, you want to set a high goal. You want to try and achieve something that's really lofty, but you don't want to make the goal so lofty that you don't make any progress at all. Other people say, you really want to start with really small goals and make things very, very incremental. Only set out to do things that you know you can accomplish and that will feed back on your self-esteem and all these positive feedback loops. And then, you

know, layer by layer, layer by layer, you'll eventually get where you want to go. Well, it turns out that neither is true you need to set the level of difficulty, such that you're making errors about 15% of the time. And I want to emphasize about 15% of the time, because there's no way to figure protocols for sport or language or math or anything else, where you're going to have exactly 15% errors. So, anyway, this paper, the 85% rule for optimal learning, again, we will supply the link, but it really points to the idea of making things pretty hard, but not so hard that you're failing every attempt or even half of the attempts. Failing about 15% of the time seems optimal for learning. Hopefully that information will be useful to any of you that are trying to learn something. Hopefully it will also be useful to those of you that are teaching kids or other adults. If you're teaching, keep in mind that you want to keep the students reaching for higher and higher levels of proficiency in whatever that is that you're teaching. And that 15% of the time they should be failing, if it gets to 20%, that's probably okay. If they start failing about half the time, then probably what they're trying to learn is too difficult for them at that point. Now, of course, this is going to be controlled by all sorts of external factors, like whether or not they slept well the night before, whether or not you slept well the night before and you're being clear in your instructions to them, et cetera. But I think the 15% rule as we may call it, is a good metric to aim for and it can serve both students and teachers.

00:06:04 LMNT, Athletic Greens, ROKA

In other words, it can serve both those teaching and those that are learning. Before we begin, I'd like to emphasize that this podcast, is separate from my teaching and research roles at Stanford. It is however, part of my desire and effort, to bring zero cost to consumer information about science and science related tools to the general public. In keeping with that theme, I'd like to thank the sponsors of today's podcast. Our first sponsor is LMNT, LMNT is an electrolyte drink mixed with everything you need and nothing you don't. That means lots of salt, some other electrolytes and no sugar. As I've mentioned before on this podcast and in various interviews, I'm a big fan of salt. I sort of discovered this a few years ago, when "Science Magazine", one of the pre-eminent magazines out there, that publishes research on science, but also news articles about science, talked about the myth of salt research. It turns out, that contrary to what I had believed, which was that salt is going to cause hypertension or that salt is really bad for us. There's an innate need for salt in our system and indeed, if you dive into the

textbooks on salt balance, we have entire biological systems of our kidneys and fluid management, et cetera, that are involved in making sure that we get enough salt. In fact, neurons, nerve cells, function because salt, sodium actually enters those cells quickly and that's what causes them to fire action potentials. The common syllable or a language of neurons, if you will, when we are low in sodium, our neurons don't work as well. And a few years later, I had the experience of feeling kind of shaky and I thought I had blood sugar issues. I went and got my blood sugar checked and it was fine. And a physician made the recommendation, that I actually up my salt intake. My intake wasn't particularly low, I didn't think, but I quickly found, was that if I consumed enough salt, usually I would do this in the form of putting a little pinch of salt into some water, adding a little lemon juice or something like that, or salting my food a little bit more. That I lost any kind of shakiness in my hands, that my mental functioning was better, my sports performance was better, et cetera. So it was really interesting to see that shift simply by increasing my salt intake, something that's really counterintuitive, to a lot of what's out there. Salt isn't just important for the function of neurons, it's important for blood volume and working alongside the other electrolytes, magnesium and potassium, it ensures that cells in our body function properly. And I think we're starting to see a shift out there now, in the perception of what salt and the other electrolytes do. And really seeing magnesium, which is one of the electrolytes, potassium and especially salt, as not necessarily something to avoid, but in fact something to embrace, provided that they're used properly. LMNT is formulated to help anyone, reach their electrolyte needs and is particularly well-suited to people following a keto, low carb or paleo diet. For people following a low carb diet or doing intermittent fasting, what many people don't know, is that carbohydrate holds water. It actually brings water into the system and you don't want your system to be low on water, that's one form of dehydration.. Salt holds water as well, meaning it keeps the water in your system, which is beneficial for brain and body function. LMNT contains a science-backed electrolyte ratio of 1000 milligrams, that's one gram of sodium, 200 milligrams of potassium and 60 milligrams of magnesium. And they use the very best forms of salt, potassium, and magnesium that are out there. So the way I use LMNT, is I usually will mix up one packet into about 16 to 30 ounces of water in the morning and drink that first thing in the morning when I wake up or around breakfast time, doesn't really matter. I kind of sip on it through the morning or if I'm really thirsty, I'll drink it all at once. And then I always make sure to drink a volume of water with an LMNT packet in it, somewhere around my exercise. Sometimes it's during the

exercise, if I'm running, I'll wait until afterwards. I'll hydrate with it before and after, if it's a really hot day. If you'd like to try LMNT, you can go to drinklmnt.com/huberman, to claim a free element sample pack. You only cover the cost of shipping, otherwise it's completely free. Again, that's drinklmnt.com/huberman to claim a free sample pack. Today's episode is also brought to us by Athletic Greens. Athletic Greens is an all-in-one vitamin mineral, probiotic drink. I've been taking Athletic Greens since 2012, so I'm delighted that they're sponsoring the podcast. The reason I started taking Athletic Greens and the reason I still take Athletic Greens, is that it covers all of my foundational vitamin, mineral, probiotic needs. We of course need vitamins. We of course need minerals and we do need a healthy gut microbiome and probiotics, support a healthy gut microbiome. There is now a wealth of quality scientific published data, showing that the microbiota, meaning the little microbes that live in our gut, are good for us. And our gut when it functions properly, communicates with our brain and our brain communicates with our gut through the so-called, gut-brain axis. And that gut-brain axis, is vital for things like immune system, endocrine system, meaning hormones and for mood and overall brain function. With Athletic Greens, I get my vitamins, my minerals and the probiotics I need, to support a healthy gut microbiome and gut-brain axis without having to worry about taking a bunch of other things. In fact, when people ask me, what's the one supplement I should take, that's going to make me feel better? I always say Athletic Greens because indeed it makes me feel better and it happens to taste terrific. I drink it twice a day, typically, I'll have one in the morning, I mix it with water and a little bit of lemon or lime juice. And I'll typically have it again in the afternoon or late afternoon, again, mixed with water, some lemon or lime juice. If you'd like to try Athletic Greens, you can go to athleticgreens.com/huberman, to claim a special offer. They'll give you five free travel packs, that make it really easy to mix up Athletic Greens, while you're in the car or traveling by plane, et cetera. Plus, they'll give you a year supply of vitamin D3 + K2. Many of us are deficient in vitamin D3 and even for those of us that are getting sufficient sunshine, many of us still need to supplement with vitamin D3. Vitamin D3 is involved in metabolism, immune system, brain function, hormones, et cetera. It has so many important functions, and K2 has been shown to be important for a variety of things, not the least, which is cardiovascular health. So again, if you go to athleticgreens.com/huberman, you can claim a special offer. They'll give you five free travel packs, plus a year supply of vitamin D3 + K2. Again, that's athleticgreens.com/huberman, to claim this special offer. Today's episode is also brought

to us by ROKA. ROKA makes eyeglasses and sunglasses, that have the absolute highest quality. I spent a lifetime working on the science of the visual system and I can tell you that your visual system everywhere from your eyes to your brain, includes a ton of different mechanisms, so that as you move through different environments, you can see things clearly. And even if it's bright out or there are shadows or it's really dim outside, or it's getting dark, that your visual system can try and manage, to resolve what's out there in the world, so you can see things clearly. Many people need corrective lenses, they need eyeglasses. Other people, they need sunglasses as well, or just simply need sunglasses because if it's too bright, it's very hard to see things. One problem with a lot of eyeglasses and sunglasses out there, however, is they don't take into account, the nuanced biology, the visual system. You may have experienced this. Have you ever put on a pair of sunglasses that aren't so great? You move from a really bright area into a dimly lit area and you have to take the eyeglasses off, your eyes just don't seem to adjust. With ROKA, eyeglasses and sunglasses, everything they've done to design those glasses and lenses, is with the science of the visual system in mind. So you can move seamlessly from one environment to the next and you always see things with crystal clarity. Their sunglasses and eyeglasses are really terrific because they can be used for anything. They have a terrific aesthetic, so you can wear them, to work to dinner, et cetera, they look great. And, they're also designed for athletic performance, you can use them while running or while cycling, if you get sweaty, they won't slip off your face. They're extremely lightweight, in fact, I often forget that they're even on my face. I wear readers at night and sometimes when I drive and I wear sunglasses when it's really bright outside and I need sunglasses. If you want to try ROKA eyeglasses or sunglasses, you can go to roka.com That's R-O-K-A.com and enter the code Huberman, to save 20% off your first order.

00:13:55 Brain Circuits for Setting & Pursuing Goals

Again, that's ROKA, R-O-K-A.com and enter the code Huberman at checkout. Let's talk about the science and in particular, the biology and neuroscience of setting and achieving goals. Setting and achieving goals, is not a uniquely human endeavor. Other animals set and attempt to achieve goals, a honeybee attempts to collect honey and bring it back to the hive. A herbivore will go out and forage for plants and will also have a need to reproduce at some point in its life. So, will need to find a mate and maybe even

raise the young, depending on what species that is. Predators will have to hunt and kill and eat their food and they have to avoid getting injured in that process. They also have to raise young, et cetera. So humans are among the other animals, or we could say the animals are among us in the need to set goals and to make efforts to achieve those goals. Now, why do I emphasize this commonality of process? The reason I emphasize this commonality of process, is that it turns out that there is one basic system by which all animals, including humans, set and attempt to achieve goals. Now humans are unique in our ability to orient our mind toward immediate goals, moderately termed goals, meaning things that might exist on the scale of a week or a month or even a year and very long-term goals, like a lifetime goal or a goal that lasts a decade, or it takes a decade to achieve. That's what makes us unique. And of course we don't have access to the mindset or the thinking or the emotions of other animals, but what we do know is that, common neural circuits, meaning brain areas, that are present in animal species and in humans, are responsible for orienting our thinking and our action toward particular goals. Another thing that's really unique about the human brain, is that we are able to have multiple goals interacting at once. So, for instance, we probably all have fitness goals, goals in relationships of different kinds, friendships, and romantic partnerships as well as maybe scholastic goals. Maybe you're in school or you're pursuing some kind of learning outside of the school environment or indoor, you have business goals or financial goals, we are able to have multiple goals at once. And other animals do this, but humans are unique in the ability to juggle a lot of goals. And actually one of the major challenges in pursuing goals, is that goal pursuit often interacts, meaning if you can spend 100% of your time chasing one particular goal, that might be very effective for that goal, but then we tend to fall back on some of our other goals. You can imagine how this plays out. If you're working very, very hard, you're solely focused on business often, your health will suffer. If you're solely focused on your health often, other things will suffer. And so we have to juggle both our goal setting and our goal pursuits. And so today, we're going to talk about a number of different ways, to work with what could very well be called, these interleaving goals, by focusing on a common practice or common set of mechanisms that are present in all aspects of goal seeking. What is that process? Well, it turns out, it's a neural circuit. A neural circuit, is simply a collection of brain areas, that when active in a particular sequence give rise to a particular behavior or perception. So for instance, when you feel happy, it's not because you have a brain area, that's the happy brain area, that is electrically active. Rather, it's going to involve numerous brain

areas, being active in concert and to different degrees. In the same way, that the keys on a piano, together, played in the appropriate sequence, represent a particular song. You would never say that one key on the piano represents that song, but that key is necessary. Similarly, in the brain, we can say that a brain area might be necessary, but not sufficient to give us a particular experience or generate a particular behavior. So when we think about goal seeking and the pursuit of goals of any kind in the brain, it doesn't matter what the goal is. It involves a common set of neural circuits and the neural circuit that I'd like to orient us toward today. And we will return to it a few times, involves learning a couple of names, but you don't have to worry so much about memorizing these. Just more important is to understand the logic of how it's put together and I will explain that and make it very clear. If you want to learn the names, that's great. One of the brain areas is the so-called, amygdala. The amygdala is most often associated with fear, so you might say, wow, how is that involved in goal directed behavior? Well, a lot of our goal directed behavior, is to avoid punishments, including things like embarrassment or financial ruin or things of that sort. And so the amygdala and some sense of anxiety or fear, is actually built in to the circuits that generate goal seeking and our motivation to pursuit goals. The other areas are the so-called, ventral striatum. The striatum is part of what's called, the basal ganglia. The basal ganglia, is a neural circuit, that can very simply be described as a neural circuit that helps us generate go, meaning the initiation of action and no-go, the prevention of action type scenarios. Let me make that even simpler. The ventral striatum is part of this thing called, the basal ganglia. The basal ganglia has sort of two circuits within it. One circuit is involved in getting us to do things, like I'm going to get up tomorrow and I'm going to run five miles first thing in the morning. I don't know if I'm actually going to do that, but I'm just using that as an example. Another circuit within the basal ganglia, is a no-go circuit, it's the one that says, no, I'm not going to go for the second cookie or the third cookie. I'm not going to eat that. And then the go circuit would be the one that's responsible for instead eating something else. Okay, so we have go and no-go circuits within the basal ganglia. So we've got amygdala, so what you think of as kind of fear and anxiety and avoidance. We've got, the basal ganglia, which are for initiating action and preventing action. And then there is the so-called, cortex. The cortex is the outer shell of the brain, and there are two sub regions of the cortex, that are involved in goal-directed behavior. One is the lateral prefrontal cortex, prefrontal cortex is involved in, so-called, executive function, things like planning. Thinking about things under different timescales,

so not just what we want in the immediate term, but what we might want tomorrow or the next day and how our actions currently are going to relate, to the future. And the so-called, orbitofrontal cortex, orbitofrontal cortex has a large number of functions, but one of the key functions of the orbitofrontal cortex, it's involved in meshing some emotionality with our current state of progress and comparing that emotionality to where it might be, when we are closer to a goal. So, there are basically four areas, one involved in anxiety, one involved in emotion, one involved in planning and another involved in this go, no-go action. So that's a bunch of detail, but if I wanted to make it really simple for everyone, I would say there are four areas. One is an area associated with anxiety and fear, it's the amygdala. The second is involved in action and inaction, remember go, and no-go, so that's the basal ganglia. The other one is involved in planning and thinking across different timescales, so that's lateral prefrontal cortex. And then the fourth one, is involved in emotionality, where we sit emotionally present, compared to where we think we will be emotionally, when we reach some particular goal and that's the orbitofrontal cortex. Again, you don't need to know all those names. You don't need to know all the details, just understand that those different elements are involved in the decision-making processes that lead us toward particular goals and have us update our goal seeking, et cetera. One key thing is it doesn't matter what the goal is, the same circuits are involved. So whether or not you're trying to build a company, that's a billion dollar company that's going to go public, or you're thinking about planning a craft day at home with the kids or for yourself, or you're thinking about what movie to go see. Goals, goal seeking and assessing progress towards goals, all involve the exact same neural circuits. It's really remarkable.

00:21:52 Determining the Value of Goals

It's also very convenient for our discussion today. What's going on in these circuits, can basically be boiled down to two particular things. The first is, value information, trying to understand whether or not, something is really worth pursuing or not. So, placing a value on a particular goal. The other component of this neural circuit, is associated with action, which actions to take and which actions not to take, given the value of a particular goal in a given moments time. I want to say that again. The other component of the circuit is involved in action, whether or not you should act or should not act, based on your assessment of the value of a goal at a particular moment in time. And you're going to

hear me say over and over again, in this episode, the value information about a goal is so key. Here's why, there is basically one neuro-transmitter or rather neuromodulator system, that governs our goal setting, goal assessment and goal pursuit. And that is the neuromodulator dopamine. Dopamine is the common currency by which we assess our progress toward particular things of particular value. In fact, dopamine, is the way that we assess value of our pursuits. And so, as we take a moment and we shift our attention, to the psychology of goal setting. The things that you've probably heard a bit more about, about what sorts of goals are good and how to set goals and how to categorize goals. I want you to think about how dopamine, could possibly be involved in these different processes. And the reason I want you to do this, is that all of the psychology of goal setting and goal pursuit, is wonderful because it places things into different categories. It allows us to parse our thinking and organize our thinking. But what's not often seen, in fact, I'm not aware of any literature out there, scientific or literature in the popular press or in popular books, is an understanding of how the underlying neurobiology, can be layered on top of the psychology of goal setting, to allow us to set and pursue our goals more effectively. And that's what we're going to do today. We are eventually going to arrive at a set of four practices, that when performed on a regular basis, will allow you to assess, what is the value of this next particular action step? How worthwhile is it, to do behavior A versus behavior B in order to achieve a particular goal? If any of this is vague now, I'm going to make it all very clear for you. You're going to come away with some very specific lists of takeaways that you can put down on paper, if you like. And that you can use to set goals, assess goals,

00:24:33 Psychology of Goal Setting: Assessing Value, Action Steps

and execute goals more effectively, using the neuroscience of the circuits I just described and an understanding of the neuromodulator dopamine. Let's take a look at the psychology of goal setting and goal pursuit. This is an enormous literature, meaning there are tens of thousands, if not hundreds of thousands of scientific papers about the topic of goal setting and goal pursuit. There's also a lot of information on the internet about goal pursuit. And in looking over this information, one comes to appreciate pretty quickly, that acronyms are a big thing. Acronyms, seem to dominate the area of goal setting, especially as it relates to things in the business sector, but also in the relationship sector. Now, acronyms are wonderful, they allow us to organize our thinking

into less and conceptually they can be very useful. But as I moved through this literature, I started to see some redundant themes. And so what I've attempted to do, is distill out the redundant themes, that regardless of the person teaching or the scientific laboratory that happened to come up with these acronyms, that they boil down to some common features. So let's talk about that literature and I think we'll come away with an understanding of some basic elements that are common to all goals. Now, the modern science or the modern psychological science of trying to understand goal setting and pursuit, actually dates back to the 1930s. And we have to be sure that members of our species, were focused on goal setting and goal pursuit, long before the scientific literature emerged. It just stands to reason that, since the human brain hasn't evolved that much, we don't think, in the last 10,000 years, that people would be thinking about these things. They just didn't get them down into papers, that we could evaluate on PubMed and so forth, but now we can, so we can look at those papers. And what you find is that acronyms are abound in the psychology literature about goal setting and goal pursuit. So for instance, you'll hear about the work of Larkin Small, for instance, these are the last names of various researchers. The so-called, ABC method, that a goal should be achievable, it should be believable, and that the person be committed. It's sort of obvious once you hear about the ABC method. Then people came along and expanded on that, they talked about the so-called, SMART method. SMART being another acronym, that it be specific, that the goal be measurable, that the goal be attainable, that the goal be realistic and that it be time-bound, meaning that you set up certain period of time in which a given goal should be performed. And then people come along and modify these, this is the way that psychology research is done. I'm not laughing at it. I'm just chuckling because, it seems like the acronyms get longer and longer and longer. They developed the, SMARTER approach, adding an ER to the acronym, SMART, S-M-A-R-T-E-R. They added ethical and rewarding, which fortunately, are good things I believe, ethical and rewarding. What does all this mean? Well, what it means is that any kind of goal pursuit, any kind of goal setting, really has to involve a number of different states and neural circuits in the brain and body, at least that's how I view this literature. Why would I do that? Well, let's think about the very modern version of the kind of acronyms that I talked about a moment ago, dating back to the 1930s and extending into the 1990s. You can find beautiful talks online from people who have worked with some of the biggest companies and greatest high performers out there, to achieve incredible things. And they will talk about generating a sort of objective

mindset for goal setting. They'll talk about goals needing to be significant. That it has to be a big goal. That it has to be concrete, so you have to be able to describe what the goal is. It has to be action-oriented, has to be inspirational, has to be time-bound. You have to have reasonable, realistic, verifiable measures. You have to constantly up the ante. If it's starting to sound repetitive, it's because it is repetitive. There are basically only three or four elements, to goal setting and goal pursuit. Basically, an individual or set of individuals, has to identify a specific thing that they're going to attain. In some communities, they talk about, knowing what right looks like, meaning being able to define a very specific goal. You can't just say, I want to be a champion athlete. You have to say what sport, and you have to understand what the path to that is. So any big goal of course, is broken up into a series of smaller goals, but the whole thing starts with thinking about the end in mind. And in a few minutes, we will talk about, whether or not visualization of the end in mind, is actually beneficial or detrimental to achieving goals. There's actually great neuroscience and psychology data on that now. So, I mentioned all these acronyms, not as an attempt to disparage them. I think they're wonderful. And I mentioned all that psychology literature, not in an attempt to disparage it, but rather just say that, goal setting is the first step, assessment of whether or not one is making progress towards those goals is the second but necessary step. And then there's the business of goal execution. And that brings us back to the neural circuit components, remember, this neural circuit, involving those four things earlier, the amygdala, striatum, orbitofrontal cortex and the prefrontal cortex. They work together, to divide the whole process as I mentioned before, into two general categories. The first is, assessing value, knowing whether or not where one is at one given moment, relates to some external thing. Are things going well or things going poorly? And knowing how to gauge that accurately. And then, action steps, goes and no goes, do more of this, do less of that, do this, don't do that, et cetera. So, now we are going to shift back to the neuroscience and we're going to talk about the practical applications of the information I just described. Because I've given you a lot of kind of academic information. And as we do this, I'd like you to keep in mind, what are some things that you've either accomplished or that you'd like to accomplish going forward? Because as we do this, we can build toward a set of protocols, that at the end, you'll be able to very quickly plug in, your particular goals and a route to those particular goals, that's grounded in the science. That I think are going to be very effective

00:30:29 Peripersonal Space vs. Extrapersonal Space

in allowing you to reach those goals, more quickly and with indeed less effort. In fact, let's start with a tool now because as we move through all this information, I want to make sure that people are coming away with some practical things that they can implement. And indeed, some things that you can even do during the course of listening to or watching this podcast. The first thing to do, is to understand the difference between peripersonal space and extra personal space. Peripersonal space, is all the space, literally, that's within inside your body, the surface of your skin and in your immediate environment. Peripersonal space, is a key concept in neuroscience because you have particular neural circuits and particular chemicals, that are geared toward, what are called consummatory behaviors, meaning, using things and consuming things and enjoying things, that are in your immediate peripersonal space. Let me give you an example of this for myself, just to make it concrete. You can imagine similar examples for yourself right now. Within my current peripersonal space, is my interoception, my understanding or perception of my internal body. So, how quickly I'm breathing, my heart rate, the feelings on the surface of my skin, et cetera. But also, within the confines of my peripersonal space, is this coffee mug, that if you're listening to this, you can't see this, but I'm lifting up a coffee mug, I'm going to take a sip of coffee. That's a consummatory behavior, I have the coffee, I don't have to do much or motivate much to get it. I have other things here, pens and computer, et cetera. So things in your peripersonal space and consuming those things, is generally governed by a set of neurochemicals, that center around the neuromodulator serotonin. And there are a few others as well, things like oxytocin, but mainly serotonin. Contrast that, with the so-called, extra personal space. Extrapersonal space is everything beyond the confines of my reach. It would be something in the next room. It will be something down the street. It will be something at some other location, in space and time. And the neuromodulators and neurochemicals, that are associated with any kind of thinking about, anything in the extra personal space, are distinct from the neurochemicals and neuromodulators, that are involved in thinking about or making actions towards the peripersonal space. And the molecule that's most associated with thinking about or orienting toward the extra personal space, again, things beyond the confines of my skin or your skin, is dopamine. And this is a vitally important concept to understand, when you're setting goals and seeking goals. If we are to be good at goal seeking, if we are to be good at setting goals and assessing goals, if

we are to achieve our goals, we have to be able to toggle back and forth between a clear understanding of our peripersonal space, what we have and how we feel in the immediate present. And our ability to understand what's out there in the extra personal space and our ability to move into that extra personal space. And a simple way to conceive of all this, is that we evaluate our progress in the peripersonal space. We evaluate how we feel, about some pursuit, even if we haven't initiated that pursuit yet. How we feel about a particular goal, is truly a feeling that we experience in the here and now, even though the goal is in the future. If we are going to evaluate whether or not, we made progress today or yesterday or not, that's an evaluation of how we feel in the immediate peripersonal space. However, moving toward any goal, involves orienting our thinking towards the extra personal space. And as we go through today's episode, I'm going to teach you a technique or rather a neuroscience-based tool, that will allow you to continually transition back and forth between the peripersonal space and the extra personal space in a way that will allow you to update and evaluate and better execute your goal seeking. The whole principle behind this, is that human beings, like other animals, have to make evaluations about whether or not they are on the right track. However, the important thing to understand, is that humans in particular can do this over different timescales. We don't just pursue food 'cause we are hungry, we pursue food, excuse me, for a particular meal, that we might be having with people tomorrow. We can modulate the timescale in a way that other animals don't. That's how we adjust our goal seeking, to different timescales. And in addition to that, humans are exquisitely good at biasing our behavior toward particular goals over very long periods of time. But there are a lot of mistakes out there, in fact, things that are outright wrong in the literature and in particular, in the internet, and then the kind of wellness and fitness and cognitive fitness space, that send people down the wrong path and those things we will talk about in a few minutes. But things like visualization, that visualization and visualization of this big goal, is the best way to achieve your goals.

00:35:39 Visually Focusing on a Goal Line Improves Performance

In fact, that's not the case, there's a much approach to doing all this. So now I'd like to shift gears towards talking about a few of the things, that most people get badly wrong in setting and assessing and executing goals. This is based on peer reviewed research, so I think it's very solid. I know it is very solid. And it runs counter to what many of us have

been taught. Let's start with a simple one. We've all heard that multitasking is bad. We've heard multitasking is bad, it doesn't allow for focus. If you want to achieve anything, if you want to accomplish anything, you should not multitask. Well, it turns out, that's wrong. It turns out that there is a role for multitasking, but the multitasking has to be placed at a particular time within your goal seeking behavior in order to be effective. Really nice studies done at Carnegie Mellon University, and the Davis Lab, evaluated how long people are able to focus in different environments. How long they were able to stay concentrated on their work. And it turns out that number is exceedingly low. It turns out that most people, whether or not they're doing computer work or whether or not they're doing writing or accounting work or anything of that sort, can hold their attention for about three minutes at a time before they shift their attention off. And that's ridiculously low when you first hear it, but, that probably reflects a basic state of brain function. That harkens back to a time when we were hunter gatherers, I doubt that we were maintaining focus solidly for hours and hours and hours, unless we were under some particular threat or in some particular crisis. Rather, you could imagine that people collected seeds and nuts and berries for about three minutes and then probably stood up, looked around and then kept going. Or that they were hunting animals or in some sort of pursuit, fishing, et cetera, and focused, focused, focused and every three minutes or so, they might've looked up and, you know, take a look at the sky or looked around to make sure that other people were there or not there, et cetera. It all stands to reason that that will be the case. Again, the neural circuits haven't evolved much. Now, multitasking, has been shown to have a very interesting physiological signature, when we multitask, when we jump back and forth between things, there is an increase in the level of the neurotransmitter, also sometimes called a neuromodulator, but basically same thing for sake of this discussion. There's an increase in the neurotransmitter epinephrine, which is adrenaline. And so, there are really nice studies now, pointing the fact that doing a bit of multitasking prior, to jumping into some focused, goal directed behavior, whether or not it's mental behavior or physical behavior, can actually be useful because it gets us into action. So we've all been told that multitasking is terrible, but if you, for instance, find yourself cleaning up your house and also checking your phone and doing a number of things, right at the point where you should be sitting down to write or do some focused work. It probably reflects some adaptive mechanism, where you use action and somewhat varied multitasking action in order to generate adrenaline in your system, because adrenaline just gets you in the action. Now, that's great, but, you don't

want to multitask throughout any kind of goal seeking or goal pursuit behavior. Because, what's also very clear and we're going to talk about this in exquisite depth today, is that visual focus and in particular contracting your visual window, bringing the aperture of what you see, to a very fine point, can absolutely increase your clarity of goal seeking and the likelihood that you will pursue your goals. I've talked about this a little bit before on the podcast as a way of increasing focus for any kind of pursuit. I've talked about a practice, whereby you can literally look at a dot or a line, placed on a wall or on your computer in front of you for 30 to 60 seconds, and then moving into some dedicated work, where you need to focus. And indeed, just looking at a narrow piece of the visual world, a small piece of the visual world for some period of time and forcing yourself to hold that gaze on that location as best you can, can increase your level of cognitive attention and your ability to focus and stay focused. And this is not magic. It is the consequence of the fact, that most of your cognition follows your visual perception. For those of you that are low vision or no vision, meaning you're blind, or you have trouble seeing, my lab does a lot of work with people, who are low vision, no vision. They tend to use their auditory system, their hearing, as a way to anchor their attention to particular things. But most people out there can see and see pretty well and visual focus is the way to do that. Now, earlier, we were talking about this notion of peripersonal space versus extra personal space. And I'm just going to seed a little bit of the later conversation by saying, that when we focus on an external point. We are in a process of exteroception, is the focus on the extra personal space, not the peripersonal space. So when we focus on something, say a line on the wall for 30 to 60 seconds or at our computer for 30 to 60 seconds and just look at it and then move into any kind of action, whether or not it's work action or physical action. We are at its very core. We are engaging in this pursuit of extra personal space. We are placing our focus outside our body and therefore we are placing the brain into goal pursuit mode. Work at NYU, in particular, in the laboratory of a phenomenal researcher in their Psychology Department, by the name of Emily Balcetis, B-A-L-C-E-T-I-S. Emily Balcetis, has done really nice work on this. They've done is, they've had, people focus their visual attention on a goal line of some sort and then to engage in some sort of behavior, that requires a lot of effort. And they've done a lot of different experiments like this, but I'll just explain one. They always include a control group, where people have to go through the same physical effort or mental effort, but they don't focus their attention just on one location. The long and short of these studies is that, when people have to focus their attention on one location, like a goal line, they

are much more effective in reaching those goals and they achieve them with the perception, that they expended less effort. I'll give you an example of one particularly nice study from the Balcielis Lab. So this particular study involves, physical exercise. Although, as I mentioned before, they've done similar studies looking at cognitive type work. And what they did is they had a group of people, exercise, wearing 15 pound ankle weights, and they had to basically move a certain distance or run a certain distance to reach a goal line. One group was focused on the goal line, visually focused, on the goal line. The other group was not told to visually focus on the goal line. And what they found, was that the group that focused on the goal line, was able to achieve reaching that goal with 17% less effort. They measured effort and they got there 23% quicker. That's a remarkable difference. So same distance traveled, with same workload because everyone's wearing the same 15 pound weights on their ankles. One group is simply looking at the goal line, the other group is not told to look at the goal line, simply by looking at the goal line, does something to the psychology and end physiology of these people, that allows them to move forward with less perceived effort and to do it more quickly. That's remarkable. And in this case, they're focused on the goal line, but in a few moments, we'll talk about how one can use updating of goal line, so incremental goal line. Starting with an intermediate goal, and then extending the goal line further and further. But just sit back for a second and think about that, just by changing where a person looks, they changed their perceived effort and their ability to do something, more effectively, more quickly, than a group that is not deliberately focusing their visual attention on one location. That's incredible. And it's so incredible, in fact, you might say, well, how could that possibly be? Well, it turns out, it has a very specific, underlying physiological reason and that has to do with changes in our so-called, autonomic nervous system. The aspects of our nervous system,

00:43:50 How Vision Improves Performance: Blood Pressure

that prepare us for readiness and action, or that prepare us for resting and relaxing. So what is special about focusing one's visual attention at a given location? Well, it turns out that we have two branches of our visual system. So visual information all comes in through our eyes, but then it can head down two different pathways. One pathway is engaged when our vision is brought to a common point, what we call, a vergence eye movement. So if we're focusing very intensely on a given point, regardless of how far

away from us that point is, our visual system engages a certain set of neurons, neural circuits that are involved in resolving fine detail and that can evaluate small changes over small periods of time. Just think of it as a very detailed camera of the visual world. It tends to be very restricted. The other pathway through the visual system, is the so-called, magnocellular pathway. And this is a pathway that's involved in taking in global information about lots of things, that are happening around us. Movement of things to our right, movement of things to our left, things are happening down on the ground and all around us. And that pathway involves a sort of relaxation, if you will, of the neural circuits that are associated with alertness and attention. When you walk down the street and you're not thinking about much, provided you're not looking at your phone, you're not focusing on one location, you're more or less in a relaxed state, compared to when you're looking for a particular sign, you're looking for a bus or a train that's coming, or a particular person. And that should inherently make sense, when your level of attention and alertness goes up, there's sort of a small, but perceptible increase in your level of arousal. It's not really stress necessarily, but arousal of alertness. And it turns out that the visual system, accomplishes this increase in alertness by communicating with your circulatory system and the system that delivers blood and nutrients and oxygen to the rest of the tissues in your body. So let's talk for a second about what focusing our vision on a particular location does because in this study from the Balcetis Lab, what they found was, focusing on a goal line allows people, to move more effectively toward that goal. This is something you can leverage in all aspects of all goal pursuits. What happens when we focus on a particular location? Believe it or not, there's an increase in a particular feature of our blood pressure. Now your body has, of course, arteries, veins and capillaries, and your heart pumps blood, first to the arteries, and then to the other components of your vascular system. And we have so-called, blood pressure. Blood pressure is just how much, the fluid volume is pressing on those arteries, veins and capillaries. So you can imagine a pipe with very little fluid moving through it, that's low pressure. You have a pipe with a lot of fluid moving through it, that's even more pressure. You have a pipe with a lot of very viscous, meaning, very kind of sticky, thick stuff, moving forward, that's even more pressure. We have blood pressure and you've probably had your blood pressure measured. There's always two numbers. You have a top number, which is the systolic blood pressure. And then there's the bottom number, below the line, which is the diastolic pressure. So the important thing to understand, is that your blood pressure will rise when your heart beats, because there's more fluid

moving through those pipes that are your arteries or veins and your capillaries. And that top number is called the systole or the systolic blood pressure, because that's the pressure at the time, when your heart contracts. So the top number, which normally, if you have a healthy blood pressure, is somewhere in the range of 90 to 120 millimeters of mercury. Millimeters of mercury is just the way, that pressure is measured. That top number, your systole, or your systolic blood pressure, is what's measured when the heart contracts. So, that's the amount of pressure when there's a heartbeat and it's moving through your vasculature. Now, between beats, the heartbeats, but then it relaxes, your blood pressure is going to drop to a lower value because fluid isn't being pumped through the system at those moments. And that's the bottom, the diastolic pressure. And typically for healthy people, that's going to be 60 to 80 millimeters of mercury. So you might hear about a normal blood pressure being about, again, this is an approximate, 120 over 80. What that means is, at the point where blood was being pumped through there, your arteries and veins, boom, that it's 120 millimeters of mercury, but then, when the heart relaxes for a second before the next beat, then it drops to 80. So there's high pressure, low pressure, high pressure, low pressure. The fluid is being pumped through the system. Now, why am I telling you all this? Well, it turns out, that there are neural circuits that link your visual system and focusing on a particular point with that top number, the systolic blood pressure. And when you focus your eyes on a particular location, that systolic blood pressure goes up, and there are some other systems that are coordinated with it in your brain and body, that start releasing adrenaline, low amounts of adrenaline in most cases. And that adrenaline, further readies your body for action. So, bringing our visual focus to a particular location, does a number of things to the brain and the whole system of the body, to prepare it, to place it into a state of readiness that makes us more likely to lean into our goals into action. And if we step back and think about this, this makes perfect sense. The brain and body need to be coordinated. We can't just think about a goal. In fact, a deer or a lion, can't just think about a goal. It has to think about a goal and then has to feel some sort of activation energy, some willingness or desire to move forward in pursuit of that goal. So imagining a goal, has to be coupled to the physical pursuit of the goal. So our visual system in a beautiful way, brings together a focus, literally, a visual focus on a particular point outside us. Then it recruits an increase in systolic blood pressure, which creates a systemic, a body-wide and brain-wide increase in fuel utilization, in oxygen availability, in our willingness to move forward as a body, as a whole coherent system. And then there

are also neurotransmitter systems, like epinephrine, as we will soon see dopamine, that get recruited as well to place us into a continual mode of action. This to me is a remarkable feature of our physiology and it gets right to the point of some of the psychological phenomenon that we were talking about earlier. Let's just recall what some of those are. I won't list them all, but, a goal has to be significant, they say. All the psychologists, all the popular stuff online says, it has to be significant, has to be inspirational and has to be action oriented. So let's say you look out into the landscape of what's available to you, whether or not it's just in your mind, or you look at a specific point, you say, I want to go to that particular restaurant, to eat that particular food. And you orient towards it and you move towards it. This is the way that your brain and body, are coordinating their actions together. Conversely, when our visual system, is in a mode of looking at everything. When the aperture of our visual system is very broad, we know that there's also a reduction in our goal directed behavior and a reduction in the systolic blood pressure. It's as if our peripersonal space is sufficient, we don't need to get beyond our current state. We're not oriented toward any one thing in particular. So I've now described some of the psychology and some of the underlying physiology. Now, I'd like to mesh this within the context of actual specific goal setting and goal pursuit. Because what many of you are probably thinking is, well, that's some physiology, there's some psychology, but how do you actually apply this towards setting and achieving goals? Well, you do that, by understanding that your mental frame and your attention are always either positioned, to your peripersonal space, focused on your immediate possessions and state, or towards things outside you. But then you also have the ability, to dynamically travel back and forth between those. And so next, we're going to talk about, what the literature says about things like visualization, immediate and intermediate goals, long-term goals and how to best achieve those. And then we're going to move specifically into the protocols that you can use. It's a protocol that I've specifically developed for you, the listeners, in order to incorporate all the signs into a best practice, that you can do any time, any place, to really identify what it is specifically,

00:51:55 Tool 2: Use Focal Vision to Initiate Goal Pursuit

that you want to pursue and the best route to pursue and achieve that goal. Focusing our visual attention on one particular point, is incredibly effective for all types of goal pursuit. And if you'd like to read some of the scientific studies or read a review of the

scientific studies, that have looked at how, narrowing one's visual attention, can really enhance the effectiveness of pursuing goals, I'll put a link to this study. The title of the study is, keeping the goal in sight, testing the influence of narrowed visual attention on physical activity. And this is a paper from Emily Balcetis's Lab, focuses mainly on physical activities, but it mentioned some other things as well. This is an article published in Personality and Social Psychology Bulletin in 2020, so it's recent. It's an exceptional paper in my opinion, really gets to the heart of how all this works and some of the examples of where it's been implemented. So let's apply this visual tool, in a very simple way, to any type of goal that you want to pursue. If you already know what goal you want to pursue, maybe it's a workout, maybe it's a cognitive work of some particular sort. Again, the process is very simple. You're going to focus your visual attention on one point beyond your peripersonal space, so it could be on your computer. It could be on the wall, it could be a horizon. It could be at a distance and you're going to focus your visual attention there. And with some effort you're going to hold your visual attention for 30 to 60 seconds, you might blink, that's okay, but you're going to try and hold your visual attention there. So no moving your head around. No diverting your attention to other locations. Some people will find it very easy to do. Other people will find it quite hard. Your mind may drift cognitively, that's okay, but try and bring your visual attention to that common point. Several episodes ago, I talked about how, there are actually studies looking at developing this kind of training in students, for ADHD and the data on that are actually quite encouraging. So for people who have ADHD and focus issues and attentional issues, this can be effective. For people who don't, this can also be effective. Again, it places your brain and body into a state of readiness and then the idea is to move into the particular actions, that bring you closer to your goal. We haven't yet talked about how to set goals and how to assess progress. This is simply how to pursue goals. But the visual component is important, in fact, I would argue that the visual system and harnessing your visual attention to a narrow point, is going to be the most effective way, to get your brain and body into a mode of action, to pursue whatever goal it is you're trying to pursue. That practice is in stark contrast to multitasking, where by definition your attention is moving from place to place to place. I mentioned that multitasking can be effective in getting your system into somewhat of an increased level of activation, so that you can pursue a more focused goal. But the visual attention to a particular point, is going to be the most effective way to bring your system

00:54:40 Tool 3: Use Aged Self-Images to Self-Motivate

into a state of readiness and action for goal pursuit. There's another really interesting way, that you can leverage your visual system toward long-term goals. The Balcetis Lab has also done, some really interesting experiments, looking at people's ability to set and stick to long-term goals. And the long-term goal that they looked at, was one related to saving money for later in life. This is something that a lot of people struggle with, a lot of people have a hard time investing money or saving money for later in life. Simply because as human beings, we vary in the extent to which we worry about what's going to happen later. There's also a phenomenon of so-called, delay discounting. Delay discounting, is the fact that goals, become less rewarding when they exist further out in the future. You may have experienced this walking past a donut shop. I love donuts I'm just going to admit it, over and over again on the spot. I love the smell of them. I love the taste of them. I try to eat them 'cause I'm told they're not that good for me and indeed, I don't think they are. I occasionally cave and I'll eat one or many. But in general, I try not to cave to the immediately rewarding properties of the smell and the taste of the donut. But, what we know is that if you smell a donut or you smell a wonderful piece of food, in the immediate term, it brings your level of focus, your mental focus to the immediate phase. And it feels very rewarding, like if you had it now, it would just be so good. But if you actually extend that reward out to tomorrow or the next thing you think, today happens to be a Saturday, that we're recording, but, on Tuesday morning, I'm going to get a donut. It doesn't have the same value because the reward system, doesn't work as well for long-term goals. It's not as salient. It's not as tangible, a goal, especially for something like a donut. Whereas the kinds of goals that work, when you place them out to the longer term and can create a heightened sense of motivation, tend to be things that are much more rewarding to us. So delay discounting simply says that, the further out in time that a given goal is, the less effective that reward will be in motivating one's behavior. And indeed you see this with saving money for retirement, you see this with all sorts of long-term investment, The Balcetis Lab, therefore did an experiment, where they looked at people's tendency to save money for later in life. But the groups that they created in this study, were really interesting. They had one group, imagine, what it would be like to be 30 or 40 years older. And then to invest a certain amount of money, according to whatever it is they thought that they would need. And they measured the amount that they had set aside and saved for later in life. The other group, actually

viewed photos of themselves, so picture, images of themselves that were artificially, digitally aged, so that they could see themselves 30 or 40 years into the future. And it turns out that people in that second group, simply by perceiving their own image, in the future, invested far more money into later life. They set aside more money. Somehow it bridged the gap between their immediate experience of life and the longer arc toward what it was going to be like in 30 or 40 years. So very powerful result in my opinion, because what it says again, is that our visual perception of the future or our visual perception of the present, is what allows us to anchor our goal directed systems and our motivation to take on things that in the immediate term might not seem that useful. So, you can imagine all sorts of variations on this. You can imagine that every time I want a donut, I'd see a vision of myself or an actual physical picture of myself as a consequence of having eaten many donuts every day for the next 10 years. I don't know what that image would look like 'cause I've never seen it. That's not an experiment that I necessarily need to do because I'm not that motivated to eat donuts, but I have to confess, I am somebody who I think I'm pretty good at managing resources. But I think if I were to see an image of myself at 70 or 75, there's so many things that are associated with visual images. Like what our body must feel like, what our needs are probably going to be like in that state or in that age. What sorts of things we may or may not still be able to do at that age. And that anchors back to immediate goal-directed behaviors, such as setting aside money for retirement. Such as investing in one's health practices. And indeed there's a study that has looked at how people will invest in exercise and healthy eating. If they just think about the future and what they might be like in the future versus seeing images of themselves in the future, if they were to go down a healthy or unhealthy route. So again, the point is that the visual system, what we see, is principally important in defining what we do in the immediate term. Even if what we see relates to something in the far off distance. I think these are phenomenal studies and they get right down to an important issue that's been kicked around

00:59:33 Tool 4: Visualization of Goals is Only Helpful at the Start

over and over in the literature and in the discussion about goal seeking, which is visualization. We here keep the big goal in mind, focus on the big goal. So now we're going to address, what does the science say about visualizing big goals? If you're somebody who's interested in business, or let's say you're focused on relationship, is

thinking about the perfect relationship and what that would look like and the family that you would have and where you would live. Is that effective in generating the kinds of behaviors that will lead you to that? Is it effective to think about the big win at the end? Well, it turns out it is, but you have to be very, very careful with when and how you implement that visualization. 'Cause if you do it correctly, it can really serve your goal seeking well. And if you do it incorrectly, it can undermine the entire process. So, does visualization work? Well, turns out, that visualization of the big win, the end goal. So the Superbowl win or eight gold medals in the Olympics or graduation from the university of your choice or making a certain amount of money or finding the partner of your choice, et cetera. That visualization is effective in getting the goal pursuit process started, but it actually is a pretty lousy and maybe even counterproductive way of maintaining pursuit of that goal. Meaning continuing to engage the sort of actions that are going to get you to eventually achieve that goal. I think this is going to be surprising to people, at first, but if we think back to our discussion about the physiology of the blood pressure system, it'll make sense. Good scientific studies have been done where people are told to imagine, or even script out their long-term vision and goal for themselves. What is the big goal? And they're talked to, or told to imagine it with a rich amount of detail. To think about how it's going to feel in their body and the big win. And basically what happens is, if you measure people's blood pressure or other metrics of physiology, you see an increase in that systolic blood pressure. There's an kind of a ramping up of the readiness and excitement for that goal, but that increase in blood pressure quickly wanes. And over time, that visual of the long-term goal, becomes a poor thing to rely on in order to generate the actions that are required to reach that goal. In fact, there's a much better way to maintain ongoing action toward a goal that also involves visualization,

01:02:05 Tool 5: Visualizing Failure is the Best Ongoing Motivator

but it turns out it's not about visualizing success. It's about visualizing failure. The Balcetis Lab and other labs have looked at whether or not people make progress toward goals of different types. Whether or not they're thinking about the goal. They're thinking about that goal line and what they want to achieve, that long-term goal and all the wonderful things associated with it, or whether or not they're thinking about all the ways in which they could fail, en route to that goal. This is not typically what we are encouraged to do. Typically, we are told don't imagine failure, push failure out of your

mind, only focus on success. Fake it till you make it, or is a phrase that I absolutely hate, frankly, because it's not even clear what that means. And it's not even clear what the ethical form of that is. I think it means continue despite any anxiety or fear that things won't work out. But if you look at the literature, the scientific literature, what the Balcells Lab and other labs have shown, is that there's a near doubling, near doubling in the probability of reaching one's goal, if you focus routinely on foreshadowing failure. You think about the ways in which things could fail, if you take action A or you take action B and instead, therefore, you take action C. You're supposed to think about how things could fail, if you don't get up and run each morning, if your goal is, say a fitness goal. So let's use that as an example, because even though I realized, people are in pursuit of many things, not just fitness. Fitness goals and physical goals are a very concrete thing that we can all get on the same page about 'cause they're related to actions. Let's say, somebody sets a goal of running five miles, four times a week, minimum, and as many as seven, four times a week, minimum before 8:00 AM. In a previous podcast on habits, I talked about the benefits of not necessarily setting specific times that one will do things, but setting time blocks that one will do things. So you say before 8:00 AM, you're going to run five miles and that's going to happen up to seven days a week. One version of this would be, okay, sit back in a chair and think about how great you're going to feel and look, if you're doing this every day. How your health is going to improve. How everything's going to be, your blood markers, of lipids, et cetera, are going to improve, okay, fine. That's the visualization goal of visualizing the end point. It turns out that is far less effective and maybe even counterproductive, compared to thinking about what's going to happen, if you don't do this. The negative health outcomes that are going to occur, the disappointment you're going to have in yourself. The fact that you're going to wait until 7.30, that's not long enough for many people to run five miles. You got to put on your shoes as there could be pouring rain or even hailing or snowing, outside. And now you're not going outside unless you're somebody who's particularly motivated to do that. So, foreshadowing failure turns out to be the best way to motivate toward goal pursuit. In fact, as I mentioned before, there's a near doubling in the likelihood that people will reach goals of any kind. When they're constantly thinking about how bad it's going to be, if they fail. If we think back to the neural circuit associated with assessing value in our goal pursuits, this makes perfect sense. The amygdala, that center of the brain that's involved in anxiety and fear and worry. Well, the amygdala, is one of the four core components of our goal setting and goal pursuit circuitry. And there's no bypassing

that. there is no one listening to this or watching this who's amygdala is not involved in their goal setting and goal pursuit behavior. And so, while I'd love to be able to tell you that all you should think about is rainbows and puppies and all the wonderful, rewarding things that are going to happen when you achieve your goals. The truth is, you should be thinking mainly about how bad it's really going to get, if you don't do it. How disappointed in yourself, you're going to feel. How it will negatively impact you, if not in the immediate term, in the long-term, if indeed your goal is to reach your goal. So, I want to emphasize that I'm not interested in encouraging people to flagellate themselves. I'm encouraging people to achieve their goals. And it turns out the best way to do that, is by foreshadowing failure. And the more specific you can get by writing down or thinking about or talking about, how bad it will be if you don't achieve your goals, the more likely you are to achieve those goals. Part of the reason for that almost certainly has to do with increases in systolic blood pressure and increases in readiness in your system, when you imagine failure. The brain and body are much better at moving away from fearful things than towards things we want. I wish I could tell you that wasn't the case, but there is a true asymmetry in the way we are built. In fact, the brain and body can engage in what's called, one trial learning. When something bad happens, we eat a food that makes us sick. We have an interaction with a person or place that we really don't like. It only takes one trial to really... One event, one time to reorient or rewire our neural circuitry, so that we have a bias toward moving away from that thing in the future. When things go well, unfortunately, that doesn't often occur. If things go really, really well, it might orient our brain and body toward wanting more of that thing. And we'll have neural circuitry changes that will lead us to engage in that particular behavior or interaction again, but it is never as effective as these avoidance circuits. So again, foreshadow failure, if you're going to visualize in a positive way, do that at the very beginning of some goal pursuit. Maybe intermittently every once in a while, you imagine the big win of scoring perfect on exam or winning the championship or the great relationship. But most of the time, if you want to be effective, you should be focusing on avoiding failure and you should be really clear

01:07:26 Tool 6: Make Goals Moderately Lofty

about what those failures would look like and feel like. Now, let's talk about goal setting. Going back to that prominent literature, the psychology and popular literature, again, we

can hear some of these themes start to emerge. The goal should be significant, we are told. It should be inspirational. It should be aggressive, yet realistic. Well, okay, that's all fine and good, but let's get semi quantitative about this. Let's at least get biological about this. How inspirational does it need to be? Does it need to be the kind of thing that is so inspiring to me that I can't sleep at all? Well, that wouldn't be good because as I believe and I know, many of you have heard me say many, many times before, regular deep sleep, 80% or more of the nights that you go to sleep, is going to be crucial to your cognitive and mental functioning and your ability to achieve your goals in the long-term. That's absolutely clear. So, it's got to be, inspirational and exciting, but what does that really look like and what does that correspond to and how do we actually make that happen? Well, once again, there is a mismatch between what the real data show and what we're most often told. Turns out, that again, work in Balcetis Lab, but also other laboratories, has addressed whether or not the probability of achieving a goal, goes up or down, depending on whether or not one visualizes or sets a goal that is easy, moderate or impossible. An impossible goal would be, for instance, if I say, I'm going to jump from my front driveway, all the way up to the road, the road's, quite a distance away, it's more than 20 meters away. It's just not going to happen. It's not going to happen in this lifetime, it's not going to happen in any other lifetime. Not unless it involves some elaborate technology that I'm not aware of, a jet pack or something like that. It's just not going to happen. An easy goal would be something like, can you jump? Or could I jump, two feet in front of me, obviously, yes. Now I'm using a trivial example here, but this could be translated to any kind of goal, school goal, physical goal, et cetera. It turns out that, when people set goals, whether or not they are nutritional goals, eat more of this or eat less of that. Whether or not they're fitness goals, run more, lift more. Some other goals, swim less, swim more, whatever it is their goal happens to be. Some learning goal, some relationship goal, some attempt to modify their behavior. It turns out that if the goal is too easy, it's too within reach, it doesn't recruit enough of the autonomic nervous system to make pursuit of that goal, likely. Now that might be surprising, at least it was surprising to me, you think, well, something is really, really easy. there's a very low bar to achieve it. People are probably more likely to do it. But turns out that's not the case, when we hear that a goal needs to be inspirational, what do we mean? When we hear that something's too easy, to recruit our action, what do we mean? Well, Balcetis Lab measured, systolic blood pressure, and found that, when goals were too easy for people to attain, they didn't get that increase in systolic blood

pressure and recruitment of the other neural and vascular systems, meaning the blood systems and the nervous system that would place them into ongoing effort. And so they quickly gave up. Also, if a goal was too lofty, if it was too far from their current abilities, it didn't recruit enough systolic blood pressure. Even if people could get very excited about something mentally, it simply didn't place their body into a state of readiness because it wasn't tangible that they could actually perhaps really achieve it. So it turns out that when goals were moderate, when they were just outside of one's immediate abilities or that one felt that yeah, that would take a lot of effort. But it's within range or maybe in range, like maybe I can do it, maybe I can't. Then there was a near doubling of the systolic blood pressure in the good sense. It didn't go into the unhealthy range and a doubling or more of the likelihood that they would engage in the ongoing pursuit of that particular goal. So here we're talking about goal setting., what we're saying is, set goals that are realistic, but that aren't so realistic, that they're easy. The goals need to be realistic and truly challenging. Don't set goals that are so challenging and so lofty that they crash that blood pressure system in the other direction and make you or anyone feel unmotivated. In hearing this, it makes sense, but I don't think I would have predicted it, had they not done this very controlled study. I would have thought, the loftier the goal, the bigger the goal, the more that it recruits the autonomic system and the more that people are likely, to lean into the energy and effort to pursue and attain that goal. I also would have thought that if a goal is really easy to achieve, that it would engage the systems of action in the brain and body enough that people would sort of get into motion and pursue that goal. But neither is the case. Again, set goals that are difficult to achieve, but that are not so lofty, that they collapse your system and that you feel overwhelmed. And the important thing here, is that how we perceive a goal, whether or not we think it's within reach or not, of course will vary, depending on whether or not we are rested. Depending on whether or not other aspects of our life are going well. I mean, we can think that we are hot on the heels of a lifetime goal and everything's going well, and then there'll be some crisis interpersonal crisis, or there'll be a health crisis and you'll be shut down. And then that goal seems very, very hard to attain. So we will talk about how to update goals under different context in a few minutes. But, of course this is going to be an averaging, this isn't something that you do just once. But the takeaway again is very simple, set goals that are moderately hard to hard, but not so hard nor so easy

01:13:05 Tool 7: Avoid Goal Distraction; Focus on 1-2 Major Goals Per Year

that they don't engage your brain and body properly. Moderate goals are best, if you want to achieve your goals. Now I'd like to talk about three particular areas of scientific study, that point to goal pursuit, goal assessment and goal achievement. Previously I told you, that it's great to foreshadow failure. That that's a great way to get your system into a state of activation. I also told you that you want to set goals, that are challenging but possible. And again, here, I'm paraphrasing from the work of Emily Balcetis. I want to be very clear. There are a few other things that one can do in order to bias the likelihood, that you will succeed in trying to achieve your goals. First of all, limit your options, trying to pursue too many goals at once, can definitely be counter productive. Now I realized that life is complicated. We all have multiple goals that we're trying to pursue, but if we have particular goals that are important to us, we have to be careful to not get distracted by other goals. And many people run into this problem. So setting one or two or maybe three major goals for a given year, is going to be more than enough for most people and is actually going to be challenging for most people. Now, of course we have daily goals and monthly goals and yearly goals, but if we have big lofty goals, we need to be careful not to contaminate our mental space and our visual space with too many goals. And why do I say visual goals? Well, what various department stores and supermarkets have discovered is that, the greater, the number of things in our visual attention, the more that we can draw our attention and our goals off a line of pursuit. What does that mean? Well, let's think about it in the practical context. This has actually been done. Big department stores have figured out that if they stock their shelves, chock-a-block with many, many options of food or clothing items or objects or anything like that, people simply buy more stuff. People are very prone to orienting their attention to whatever's in front of them. You put a lot of stuff in front of them, their attention drifts, you put fewer things in front of them, their attention is more narrow. In a later episode, we'll talk about designing a workspace, that's optimized on the basis of this. It doesn't mean being in a room with nothing except just your desk and a computer. Doesn't have to be that sparse, but visual sparseness, actually can help us orient our focus and our behavior. When we have a lot of things in our visual environment, or a lot of things in our cognitive environment. It's the same thing. And so if you're going to try and pursue a fitness goal, a relationship goal, an academic goal, and a longterm life financial goal all at once, that's four things. And you're going to have to come up with systems that allow you to isolate those goals in a very rigid way. And if you do have multiple interleaving goals and

overlapping goals and simultaneous goals, in a few minutes, we're going to talk about a process that will allow you to use your visual system,

01:15:57 Tool 8: Ensure Specificity of Goals, Weekly Assessment

to align towards each of those goals, sequentially, in a way that makes it much more likely that you'll achieve them. So now let's talk about specificity of goals. We've all heard that the more specific a goal is, and the more specific we are about when and how we are going to execute that goal, the higher probability that we will actually achieve that goal. And indeed that's the case, but there's an additional feature, that's not often discussed. That is vitally important. And in fact, maybe more important than having a specific time of day or a specific end point in mind. There's a really nice study, that was done looking at recycling. This is something that a number of groups, businesses, households, and individuals are trying to do more of. They're trying to lower carbon footprint or contribute to the world in some general way by throwing away fewer things that could potentially be recycled. So this has been studied in the context of the work environment, where a business decides and lets everybody know, that there's going to be a greater effort toward recycling cans or bottles or bottles and cans, et cetera. And then, the way these studies were done, is that the janitorial staff was swapped out temporarily for researchers that actually measured the number of recyclable items that showed up in the trash and not in the recycle, as a function of the total amount of trash. Why'd I say, as a function of the total amount of trash? What's a way of controlling for differences in beverage consumption from one week to the next? Anyway, the point is they were able to very carefully measure, how much people are recycling before and after this call to action to recycle more. And what they found was, if they said, we are going to try and recycle more, try not to put cans and bottles in the trash. There of course was an improvement in recycling, but it was pretty modest. Whereas when there was a very concrete plan and everyone knew what that concrete plan was, for instance, to place all bottles and cans into the recycle, not the trash or to limit the amount of trash by 50%, or to eliminate all recyclable items from the trash. So when they made it very concrete, exactly what the action steps were, there was a remarkable, I mean, close to a hundred fold or more improvement in recycling behavior that lasted many months after this call to action was made. The takeaway from this is quite straightforward. It means that having a concrete plan is essential. You can't just say, I'm going to become a better

recycler or I'm going to do things that are better for the environment or I'm going to become more physically fit. It has to be a specific set of action steps that get right down to details about what success would look like. I've heard this before described as what does right look like? What is the actual outcome that one would like to achieve in terms of action steps? So not necessarily feeling states, it wasn't that they all sat around and said, how great we're all going to feel about ourselves in the world when we accomplish this goal? It was very concrete statements, very concrete plans about action steps that would deliver one to one's goal. Somewhat straightforward and intuitive, but nonetheless worthwhile. What it suggests is that for all of us, if we have certain goals that we want to achieve, we need to be exquisitely detailed about what the action steps are, that we are going to take and to constantly update those action steps, so that we have a higher probability of meeting those action steps. Some of you may be asking, how often should one assess progress? Well, that of course will depend on the given goal that you're trying to pursue. But in the studies that I've been referring to here, the assessment of progress and the updating of concrete plans was done weekly. So it seems like weekly is a good starting place, to address how well one performed in the previous week. And then based on that performance to update the action plan for the upcoming week. So weekly seems like a good solid rule of thumb for setting particular action goals

01:19:57 Dopamine, Motivation & Pleasure in Seeking Goals

and assessing one's progress towards the immediate and longer term goals. Any discussion about goals and goal pursuit, would be incomplete without a discussion about the molecule, dopamine. Dopamine is often thought of as the molecule of pleasure and reward, but actually it is the molecule of motivation. This is best illustrated by a classic set of studies, that have been carried out in both animals and in humans. The animal study can be described the following way, two rats, each in a separate cage. You can provide those rats with the opportunity to indulge in something that they like, like food or mating. Or heat, if it's cold in the environment, or a cool spot in the cage, if it's warm in the environment and so forth. And what you find is that, rats will very readily approach the rewarding thing. They will, mate. They will eat. They will pursue something that is of pleasure. Now, if you are to take one of those rats and deplete its dopamine neurons, you can eliminate its dopamine neurons or block dopamine in the brain. What you find, is that those animals will still enjoy pleasure. They will consume the food, they will mate,

et cetera. However, their motivation, to achieve pleasure is vastly reduced. In fact, if you place the item of pleasure, the mate, the food, et cetera, even just one rat's length away from that rat, the rat without dopamine will not even move one length of its own body in order to achieve that pleasure. And there are naturally occurring experiments in humans that mimic that result, very accurately. There are certain conditions in humans where there's a depletion of dopamine. And what you find is that, the depletion of dopamine does not inhibit an ability to experience pleasure, necessarily. It inhibits an ability to pursue or go through the series of action steps in order to achieve pleasure. So dopamine, really sits at the heart of our motivational state, to seek out goals and to seek pleasure. And this is true for immediate goals that take place within a timeframe of minutes or a timeframe of a day, or the timeframe of a week or the timeframe of a lifetime. Dopamine, is the common currency by which we pursue goals. Now, dopamine does a number of things that are very interesting. I'm going to describe a few of them as they relate to goal seeking behavior. First of all, there's a fundamental feature of how our brain releases and uses dopamine, that's called, reward prediction error. And the simplest way to think about dopamine reward prediction error, is that dopamine is released in the greatest amount

01:22:43 Dopamine Reward Prediction Error, Controlling Dopamine

and places us into a greater state of motivation, when something happens that's positive and novel. Now, an important thing to understand about dopamine, is that it's not always released on the same schedule. There are a couple of different ways that dopamine is released. And when it is released relative to your anticipation of a reward, is key. If you don't expect something positive to happen, you're just going about your day and something positive happens, dopamine and a lot of dopamine is released. I had this happen recently. I had no idea that I was going to be receiving something in the mail, but I went to the mail. I looked in the mail and I got something very positive. And I was really, really excited about this. This is a real event that happened, just today. However, if we anticipate something positive is going to happen and then that thing happens, we experience dopamine as part of the anticipation. So even before we get the reward, there's an increase in dopamine. It's not as high as it would be, if something really novel and unexpected and positive happened, but we do get an increase in dopamine. And then, when we actually experience the reward, we experience the positive thing, there's

a smaller increase in dopamine. So again, the biggest increases in dopamine are response to things that are positive and unexpected. Lesser dopamine is released when we anticipate something good will happen and when that happens, yes, we get some dopamine. And we also get some dopamine when the positive thing happens, think about anticipating a great meal with friends. We have some dopamine churning, our friends come over, then we have the meal and we also get some dopamine from that, but not nearly as much as we would, if it had all happened as a part of a big surprise. Then, there's also the case in which we predict that something good will happen, when that happens, there's an increase in dopamine just as it was before, but then if that thing doesn't happen, for instance, our friends don't show up for dinner, then there's a drop in dopamine below our initial baseline. That drop in dopamine, is the chemical essence of what we call, disappointment. Now, this dopamine reward prediction error, as it's called, can be leveraged toward trying to reach our goals because it tells us where we should set our milestones. We can't be in a mode of simply being focused on the finish line. Very few people can do that over long periods of time in a way that's effective. Now, earlier I talked about a study where people were focused on a finish line visually, and they were moving through space with these ankle weights on, but that was a very short-term goal. So, if a goal is within minutes, or maybe even within an hour or as in with our immediate visual environment, maybe we can do that. But most goals of the sort that most people are pursuing, fitness goals, academic goals, business goals, relationship goals, et cetera, involve some milestones. So, understanding what we know about reward prediction error, we can make better choices about where to place the milestones, how far out in the future to place milestones. So then the question becomes, how often or at what intervals should one assess progress? And it turns out this is very subjective, but that there's a way to make it objective. Now, in a previous episode of the "Huberman Lab Podcast", I had a discussion with the great Robert Sapolsky and we were talking about, how the brain can subjectively change whether or not a given behavior or experience, is positive or negative. And the example that Robert gave, is a really phenomenal one. It's a study that's been done in rats and also in humans where they took a rat and they had a rat run on a running wheel. Rats turns out like to run them running wheels and the blood pressure of that animal, the health metrics for that animal, the lipid profiles, many, many things improved. The rat was exercising and it got healthier and presumably happier, we don't know, we could've asked it, but we wouldn't know. It doesn't know how to tell us, but we can measure blood lipids. We can measure

blood pressure and all sorts of things. And indeed, when that rat exercised or when people exercise, they generally get healthier. Except, in that particular experiment, they had another animal where every time rat number one, ran, rat number two was forced to run. It was on a running wheel and it was forced to run, not because it wanted to, but because it was forced to. And what was remarkable, is that the physiological effects of being forced to do something, were in the complete opposite direction as they were when those same behaviors were undertaken voluntarily. In other words, the rat that was choosing to run, got healthier and the rat that was forced to run became unhealthy, blood pressure went up in a direction that wasn't effective and useful. Blood lipids got worse. Stress hormones went up, et cetera, et cetera. And you see the same thing in humans. Now, what this says, is that our subjective understanding of why we are doing something, is fundamentally important for the effects that we will get from that behavior. And indeed the effects of that behavior will have on us. So this has two major implications. First of all, in terms of reward schedules, we can decide to use any reward schedule that we want for a given behavior. We can decide that the milestones for a... Let's say a plan of getting in really terrific cardiovascular shape over the next year. We can decide to assess every day and ask ourselves how good was our progress. And if we made progress, then we're going to reward ourselves. We could do that every third day. We could do it every week. We could do it every five minutes, if we actually had the time to do that. The reward schedule, the dopamine system, is highly susceptible to the subjective effects. These so-called, top-down effects of when we decide that something is going to be good for us, if we analyze it on a given timeframe, well, then it's going to be good for us. So, what I suggest people do is pick a particular interval at which they are going to assess progress. And if you've been making regular progress towards a goal that you reward yourself and the reward indeed is all cognitive. It's all mental. It's telling yourself, yes, I'm on the right track. Now, some people will say, wait, but I want to know exactly how often I should do that. You need to do that at an interval that you can maintain consistently. So you're not going to reward yourself every minute or every step of every jog that you take, unless you can do it, every minute of every step of every jog that you take. For that reason, I think that daily or ideally, weekly assessments are going to be best. I think that checking in at the end of a week, looking back on the previous week and assessing how well you performed in pursuit of a given goal. How many times a week you ran, or how many times you studied, or how many times you did something that you wanted to do or avoided something that you didn't want to do. I think that's a

reasonable and tractable schedule to assess once a week. So that's one point, that pick a milestone that you can maintain consistently throughout the pursuit of a goal. The second thing, is that the subjective effects that were described by that Sapolsky study or that Sapolsky described rather, are absolutely essential for all aspects of goal seeking behavior. We cannot underestimate the extent to which the dopamine system and our sense of whether or not we are on the right track, is under our cognitive control. If we constantly place ourselves into a mode of thinking that we are failing, well, then indeed, we are not going to churn out much dopamine. Now, earlier, I said, we need to predict and visualize failure, but that is not the same thing as thinking about ourselves as failing. We need to predict what the outcome would be if we failed, but then encountering that and in behaving in a certain way, and thinking in a certain way, in pursuing our goals in an effective way. Maybe checking in on that each week, we definitely need to reward ourselves cognitively for the correct and successful pursuit. What this means is that anticipate and think about failure as a mechanism of generating motivation and indeed fear and anxiety, so that you lean into the correct behaviors and you lean away from the incorrect behaviors to reach your goal. But then weekly or so, whatever you can maintain consistently, you absolutely want to reward yourself cognitively by telling yourself, I'm on the right track. I got another week where I accomplish, whatever it is that I'm trying to accomplish. A concrete example that I'm following now, is this 150 to 200 minutes of zone two cardio per week, because that's shown to be very effective in improving mental and physical health metrics. So once a week, I'll check in with myself. If I reach that 150 to 200 minutes threshold, then I'll reward myself simply by checking off a box and saying, okay, I'm on track. I'm on track. I'm on track. This dopamine system is critical to re-up, to remind ourselves that we are on track, if indeed we are on track because dopamine itself provides a state of motivation and readiness to continue in the regular pursuit of our goals. Dopamine, the molecule, is actually used to manufacture epinephrine and norepinephrine. Which are other molecules in our brain and body, which put us into that readiness and action state. There are actually the molecules that help generate that increase in systolic blood pressure, that puts us into a state of readiness. So you can think about dopamine as a self amplifying system, provided that you are leveraging the dopamine system on a consistent schedule. Now, by also following a consistent schedule of self reward, you set yourself up for any positive unanticipated rewards, that may happen. So for instance, if you're checking in with yourself weekly, telling yourself that you're doing well, if indeed you are. And then out of

nowhere, for instance, you're out on a run or you're doing something, I'm using fitness as an example. But you're doing something, you find yourself performing particularly well, that's an unexpected dopamine reward that will further amplify the system. Now I know many people out there, having heard me talk about dopamine before, worry, well, can I release too much dopamine and then the whole system will crash and then I'll run out of motivation? In general, that doesn't happen unless people are using pharmacology, supplements or prescription drugs or illicit drugs to increase dopamine. This is why I'm a big fan of things like, cold showers and cold water exposure, which has been shown to lead to long-lasting 2.5 X increases in dopamine, or in some cases, supplementation with things like L-Tyrosine, which are precursors to dopamine. Or in some cases, caffeine, which can increase the number of dopamine receptors that we have, so that whatever dopamine we have floating around can be more effective in activating these motivational states. But things that really increase dopamine and then cause it to crash, can be problematic. One way to conceive of dopamine, is as a sort of dopamine wave pool. You've probably seen these wave pools, where some pressure is pushed into the pool and then you get these waves going. If those waves are consistent enough, and they're of high enough amplitude, the waves can continue to go up and down and up and down. But if it's a giant wave, if you get a huge blast of dopamine, well then a bunch of the water sloshes out of the wave pool and then you basically have to take some time off, reset that dopamine level. That's what happens in addiction and when people start pushing in a lot of drugs or other things into the system that increase dopamine too much. So today we've almost exclusively been talking about behavioral tools. It is possible to incorporate supplements and things of that sort, that can increase dopamine as a way to getting into ongoing motivational states. But I caution people about relying on those too much. Really what you want, is you want a situation where your own positive feedback, your own understanding, that you are reaching the milestones that you've set out for yourself. That you're achieving those, and that is what's causing these waves

01:34:26 How Dopamine Influences Vision & Vice Versa

or these increases in dopamine that will further amplify your motivational states. Another very interesting aspect of dopamine that I've not talked about at all on this podcast before, is actually how the dopamine system interacts with the visual system. We've

talked a lot about how harnessing your visual attention, to a particular point is great and can help serve your ability to both set and achieve goals. Really wonderful work that was done by Wolfram Schultz, who's one of the great pioneers in this area of dopamine and dopamine reward prediction error, showed that for people that have normal levels of dopamine, their visual search, meaning how they scanned visual environments, tends to be pretty constrained. They might move their eyes around a particular visual environment, searching somewhat. For people that lack dopamine, they actually have very little movement of their eyes. They don't actually tend to look very far into the horizon. They're don't have that very focused vergence point that we're talking about that kind of a... I guess for lack of a better phrase, that kind of eye of the tiger, focus on a goal. Rather, their eye movements are depleted and they're not actually evaluating horizons off in their future, they're not focused so much on the extrapersonal space. And this actually can be restored and some of these took place in Parkinson's patients and other people who have dopamine depleted, that when dopamine is restored pharmacologically, their visual focus is re-enhanced again. Now, there are a lot of details to this study that don't map perfectly onto everything that I've talked about. But the point is this, when we are focused on a particular point in visual space or a particular goal or horizon. All those systems, our blood pressure, epinephrine and indeed dopamine, get recruited to put us into a state of readiness and willingness to go pursue things in that extrapersonal space. When our visual attention is very diffuse, all of that relaxes, and we tend to be more comfortable staying in the place that we are, in our peripersonal space and the effect works in the other direction too. When dopamine is increased, our visual attention for particular things out in space, increase. So the way it works is reciprocal. When we use our visual system and in a particular way, bring it to a point of focus, it recruits chemical and neural systems in our brain and body that put us into a state of readiness and pursuit. And, when we increase certain chemicals in our brain and body, like epinephrine, like dopamine, then we also allow our visual system to be in a state of looking out at particular locations in our visual world. So the system works in both directions and some people leverage this by using things like caffeine or taking things like L-Tyrosine to increase dopamine. And again, it works both ways, there's no right or wrong way to do it. I'm a particular fan of using behavioral tools, always prior to using supplementation or any kinds of other tools because behavioral tools have a very unique feature that supplementation and other chemical tools don't. Which is that behavioral tools used over time, engage neuroplasticity. As we start to practice, using our visual

system to harness our attention to particular locations and in that way, move to our particular goals, we get better and better at using those systems. In fact, the systems for focus and motivation, themselves have plasticity, so we get better at being motivated and focused when we place our visual attention at a given location. Using chemical assistance of a safe kind, of course, check with your doctor. But things like L-Tyrosine or caffeine or those combined, yes, it will increase dopamine and will increase our ability, to engage in visual focus somewhat. But those compounds alone, don't modify the circuitry in the way that we want. So I always say, behavioral tools first, then nutritional tools, then supplementation tools and then if it's right for you and safe,

01:38:10 Interim Summary of Goal-Pursuit Steps

maybe you advance into some of the other more sophisticated tools. I'd like to just briefly recap what I've covered up until now. And again, emphasize that much of what I've covered has been based on the beautiful work of Emily Balcetis and colleagues. I do hope to get her as a guest on the podcast, by the way. First of all, set goals that are challenging, but possible, those moderate goals, not super easy, not super difficult. But moderately challenging goals, seem to be the most effective in moving people towards their goals over the short and longterm. Second, plan concretely, you need a concrete set of actions that you're going to follow in order to reach your goals. Third, foreshadow failure. This is a somewhat surprising one to me. I would have anticipated, that imagining success is the way to go. It turns out that imagining success and visualizing success, can be useful at the outset of a goal and maybe every once in a while in pursuit of that goal. But that it's not terrific for putting you in constant pursuit of that goal, rather, foreshadowing failure, visualizing failure and all the terrible things that it's going to bring, seems to be more effective. And that maps very well to what's known about the neural circuitry and the involvement of the amygdala. Focus on particular visual points as a way to harness your attention and to remove distractors. Removing distractors and getting your body and brain into a mode of activation. Getting that healthy increase in systolic blood pressure, that puts you into forward motion towards your goals, is absolutely key. So that's a brief summary of what I've covered up until now. There were other things too, of course, the dopamine system and the power of subjective top-down control

01:39:50 Tool 9: Space-Time Bridging

in regulating that dopamine system. But I want to be sure to include a tool, that's been especially powerful for me, that's grounded in the neuroscience research and in the psychology research. And as I describe this tool next, I think you'll see the ways in which it measures nicely with the work that Emily Balcetis and colleagues have done. This is something that, I've personally been doing for many years, based on my understanding of the visual system and the understanding that indeed we can move our cognition and our perception from a place of interoception and focusing on our peripersonal space. That space within us and immediately around us and on the things that are immediately accessible to us. That we can shift from that mode to this mode of exteroception of focusing on things outside the confines of our skin and that are beyond our reach, that are literally goal directed behaviors and goal directed thoughts. And this is something that in the past, I have talked about a little bit and I've talked about something called, space-time bridging. And we haven't talked too much about the time domain of the visual system today. But space-time bridging, is simply a way of using one's visual system to focus on the peripersonal space and interoception. And then gradually in a deliberate way, stepping one's focus into the extra personal space and then back to the peripersonal space in a way that gives you a lot of flexibility and control over that ability in your daily life. So, I'm going to first describe the tool, and then I will explain more about the underlying science and the underlying mechanism. Here's how you would do this. You could do this indoors or outdoors, although, ideally, you would do it in a location where you could view a horizon. It could be through a window or ideally outdoors, without a window. It could be done anytime of day. At night, it might be a little more challenging, but it goes the following way. What you first do, is you would close your eyes, this could be done sitting or standing. But you would close your eyes and you would focus as much of your attention, including your visual attention on your inner landscape, on your interoception. So that would be your breathing, your heart rate, maybe even the surface of your skin, but really focusing internally. Now, how can you focus your visual attention internally, if your eyes are closed? Well, you do that by imagining your inner landscape. So you don't have to imagine your heart beating and so forth. But what you're trying to do is eliminate perception of the outside world. You're eliminating exteroception and you're focusing all of your cognitive attention and your perceptual attention on what you're experiencing within the confines of your skin or at the level of the surface of your skin and inside your body. And you would do that for a

duration of approximately three slow breaths. So close your eyes. You do breath one, breath two and breath three, concentrating all your attention on your internal landscape. Then you would open your eyes and you would focus your visual attention on some area on the surface of your body. So for me, the way that I typically do this, will be to focus on, say the palm of my hand. So I'll focus my visual attention on the palm of my hand. And I then do three breaths again, focusing on my internal state, but now I'm splitting out a little bit of my attention from interoception to exteroception. I'm focusing on something outside me, the ratio or the split of attention is about 90, 10, about 90% of my attention is focused internally, but I'm also focusing some of my attention externally. Most people can do this pretty easily. Then, there's a third, what I call, station. I now move my visual attention to outside my body, to some location in the room, or if I'm outside in the external environment, something in the range of five to 15 feet away. And I'm trying to move 90% of my attention to that external object. So now I'm really biasing my perception and my attention towards exteroception. As I breathe, I'm paying attention to those three breaths, so that's why there's still 10%, that's focused on my internal landscape because I want to pay attention to those three breaths. But I'm focusing as much of my attention, outside of myself, maintaining just a little bit on my internal state, so I can measure the cadence of those three breaths. Then I move my visual attention to yet another station, which is further away, typically, a horizon or something as far off in the distance, as I can possibly see. Again for the duration of three breaths. And at that point, I'm trying my very best to move 99, if not 100% of my attention to that external location. And then, what I typically will do, is I will try and expand both my vision and my cognition to a much broader sphere. This is that, magnocellular vision that we talked about before, where I'm not focusing on a particular location on the horizon. I'm trying to dilate the aperture of my field of view, so I can see as much of the visual landscape as I'm in as possible. If you're in an internal, excuse me, if you're in indoors, then that might be the ceiling, the walls and the floor of the environment you're in. If you're outdoors, it would be to expand your visual focus as broadly as you possibly can. Again, for the duration of three breaths, then I would return immediately to my internal landscape. I would close my eyes and I would do three more breaths focusing entirely on my interoception, on my internal landscape or what we called before, my peripersonal space. And I would then repeat that, peripersonal space, 100%, focus on my hand, 90%, 10% on my peripersonal space or my internal landscape. Stepping out to another location where it's mostly exteroception, maybe a little bit of recognition of my internal

state, then to the horizon, then to this broader visual sphere, then back into my body. And I would work through each of those stations, maybe two or three times. The entire thing takes about 90 seconds to three minutes, depending on how many breaths you do. I said three, but you could do one or 10. It doesn't really matter. Or, it's also going to depend on, for instance, how slowly your breathing. 'Cause your breathing might be faster than mine or vice versa. What is all of this doing? Why do I call this space-time bridging? And why is this useful for goal setting? The reason I call it space-time bridging, is that the visual system, is not just about analyzing space. It's actually how we batch time. It's how we carve up time. And the simple way to state this is that, when we focus our visual attention on a very narrow point, that's close to our body and our immediate experience. We tend to slice up time, very finely. We're focused on our breathing. We're focused on our heartbeats. In fact, our breathing and our internal landscape and our heartbeats become the sort of seconds hand, if you will on our experience. We are carving up time, according to our immediate physiological experience. Whereas when we focus our visual attention outside our body, not only do we engage that exteroceptive, extra personal space system, and we start to engage the dopamine system, the goal-directed system, but we also start batching time differently. When we focus our visual system into a broader sphere of space or into a space beyond the confines of our skin, we start carving up time, our frame rate changes. Now this is useful in the context of goal setting, goal assessment and goal pursuit. Because with the exception of a very few isolated examples, almost all goals, involve setting some goal, that's off in the future, and then carving up the time between now and the achievement of that goal into milestones, that range in duration. And the rewards, even if we try and just make them every week, are going to come at some unexpected intervals and that's actually can be helpful for reinforcing behavior, intermittent reward. That's intermittent and random is the most effective reward schedule we know, but the problem is always, how do we keep our cognition in line with the long-term goal while also being focused on these more immediate goals? And so this particular practice, that I call space-time bridging, but we could give it a different name. I'm sure there are better names. Maybe you can suggest some in the comment section on YouTube, that are more accurate or map to it better. But this behavior or this practice rather, is teaching us to use our visual system and thereby our cognitive system and thereby our reward systems, to orient to different locations in space and therefore different locations in time. And that is the essence of goal directed behavior. That is the essence of setting a goal. It's about

thinking about what you want. Then it's about setting milestones that are intermediate to that goal. Then it's about assessing whether or not you're reaching those milestones. And then, it's of course about updating your goals, if you need to update your goals. All of that is an enormously confusing batch of challenges, if you think about it all at once, but if you break it down into these elements, that the visual system can help you find and move towards those milestones. I think there's ample evidence to support that and that your control over your visual system, is indeed yours, that you can deliberately set it to different locations. And then you make a practice of stepping through these different stations on a regular basis. Again, I do this each morning. I do this once a day. Rarely have I done it twice a day. Rarely have I missed a day. But by doing that, you can be very effective in teaching the systems of your brain that are related to goal setting and reward, to map to different timeframes. So, I found this to be a very effective protocol, the Balcetis work has mainly focused on visual tools that are of a single horizon. Here I'm talking about multiple what I called stations or horizons. But what's very clear, is that an ability to move from different visual stations and to do that in a deliberate way in a focused and conscious way. Clearly maps to an ability, to conceive of different goals over different periods of time. And I do believe can be greatly beneficial in allowing one to set particular goals and then move through the milestones to those goals and to constantly update one's pursuit and reward in reaching those milestones

01:49:59 Summary

and eventually, the overall goal. Per usual, I covered a lot of material today. We talked about some of the neuroscience and psychology and popular understanding of goal seeking behavior. How to assess goals, et cetera. Talked about the beautiful work of Emily Balcetis at New York University and her work on the use of the visual system, to better achieve goals. And indeed things like visualization and why forecasting failure can be more effective than forecasting success as counter intuitive as that might seem. That's what the data point to. And we talked about the importance of setting concrete plans and really what that means. And what intervals at which to assess progress. And what intervals at which to assess reward and how the dopamine system is involved. And in addition, I described this practice that one can incorporate as a daily or semi-daily practice of so-called, space-time bridging of using the visual system and your ability to deliberately step your visual system from stations that are within your body. So-called

peripersonal or interoceptive space out into the world further and further. And then back again in sequence as a way to harness and cultivate and build up these systems that link vision, space, time, reward systems and so forth. Ultimately, as you set out to accomplish your goals, there are going to be a number of basic steps that everyone will have to follow. You have to clearly identify, what the long arching ultimate goal is. You have to identify what the milestones will be. You might not know all of them at the outset, but you ought to have some idea about the intervals at which you are going to set those milestones and set your reward schedule for assessing progress in route to those milestones in your ultimate goal. My hope is that you'll be able to incorporate these tools, if not all of them, perhaps just one of them or two of them in pursuit of whatever particular goals,

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you happen to be focused on at this point and in the future. If you're enjoying and are learning from this podcast, please subscribe to the podcast on YouTube, Apple and Spotify. That's a terrific zero cost way to support us. In addition, on YouTube, you can leave us comments and feedback. You can also leave us suggestions about guests that you'd like us to include or topics that you'd like us to cover in the comment section on YouTube. And on Apple, you can leave us up to a five star review, there's also an opportunity to leave us a written review. Please also check out the sponsors mentioned at the beginning of the podcast, that's perhaps the best way to support this podcast. And in addition, we have a Patreon, it's patreon.com/andrewhuberman. And there you can support the "Huberman Lab Podcast" at any level that you like. In today's episode and in previous episodes of the "Huberman Lab Podcast", we talked about supplements, while supplements aren't necessary for everybody, many people derive tremendous benefit from them. For things like sleep and focus and so forth. It's really important that if you're going to take supplements, that they be of the absolute highest quality. For that reason, we partner Thorne, T-H-O-R-N-E because Thorne supplements, have the highest levels of stringency with respect to the ingredients they include and the precision of the amounts of the ingredients they include in their products. If you want to see the supplements that I take, you can go to Thorne, thorne.com/u/huberman. And you can see the supplements that I take and get 20% off any of those supplements. And if you

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