

THE SCIENCE OF ZEN

The Neuroscience Behind Self Identity, Zen Practice
and Awakening



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PREFACE

Why Study the Science of Zen?

Zen Buddhism has obviously gotten by just fine without any scientific explanation of what causes human suffering or why liberation is possible, so it seems reasonable to ask why study this type of science at all? From my perspective, there are a few good reasons to do so.

One major benefit of this type of inquiry is that learning about the science of Zen can be a motivator engage in Zen practice or to increase engagement if someone is already on the path. There are numerous gateways to Buddhist practice and people have a myriad of motivations for what brings them start down this path. Regardless of these initial motivations there is usually a requisite amount of faith in the process that is required.

The truth is that the Zen path is a long and sometimes arduous path and having some faith that all this effort and struggle is worth it is pivotal. Often this faith will come from seeing how Zen has “worked” for senior practitioners and teachers. Seeing awake and grounded people in action is immensely motivating. Another way to find motivation is through an internal intuitive sense of one’s inherent true nature and the related freedom that is contained in it. In Buddhism we call this intuitive sense “bodhicitta”. It is the mind that seeks and intuitively awakens. For other people, they find motivation because the logic of the Buddhist teachings simply resonates for them. The Buddhist teachings on the source and cessation of suffering are often found by people to be quite reasonable and rational and sometimes they just “click” for people.

While these three sources of faith sufficiently nourished hundreds of thousands of people to go down the path of Zen Buddhism, we are now in a historically exciting time where a fourth source of faith is possible which

is an understanding of how practice works “under the hood” inside the brain. Understanding the brain mechanics behind why we suffer and how Zen practice can relieve or end this suffering can be incredibly motivating for some people. We are now at the point where we can begin to understand the neural mechanisms of why we suffer and why Buddhism is so successful helping people find liberation. There is also quantifiable evidence from many different scientific studies that this path really makes a difference in terms of well-being, equanimity, pain tolerance and resilience. If someone is scientifically minded, knowing that this process is “real” can lead to a tremendous amount of faith in the Zen Buddhist path.

Another possible benefit for some people to study the science of Zen is that in some instances, it can be a skillful means in how it helps us understand some of the more subtle teachings in Zen Buddhism. For the most part, the Buddha was teaching experienced monks who were well indoctrinated in the spiritual theories and terminology of their time, so the Buddha rarely defined terms and often did not elaborate when he did. His sermons assumed a fairly sophisticated understanding of the underlying topics involved. Because of this, for some of us modern readers, it can sometimes be difficult to know what exactly he was talking about when it comes to some topics. In my case as an example, I had some difficulty understanding some concepts such as *samskara*, *svabhava* and the *asavas*. The process of mapping them to known psychological and neurological mechanisms was very helpful for me in understanding them in functional context. It is possible it might be helpful to other people as well. Again, Buddhism does not need this help, it is just one possible skillful means for those of us who are inclined to learn in this manner.

One other way that the study of the science of Zen has been helpful to me is that the more I have understood the inner workings of my brain and how it influences my experience of life, the better I have become at not getting carried away by my mind’s machinations. For example, there have been times when I’ll just randomly recognize, “oh look, my default mode network is grasping at this self-narrative” and this recognition will immediately trigger an effortless mindfulness that by itself weakens the grasping. After learning about how my brain works, I am much more aware of what my mind is doing. Without even trying I’ll gain this objectivity regarding mental activity that would have likely escaped my notice otherwise. This kind of “bottom up” skillful means practice has been a very nice surprise benefit that I was not expecting. Other people might find this helpful in the same way.

Lastly, the topics of Zen practice, Buddhist psychology and neuroscience are all extremely fascinating. I have immensely enjoyed the process of really diving into them. The way the brain processes reality and creates an illusion of self is an incredibly story. Understanding why the brain can cause needless suffering and seeing what the neuro correlates of the solution to this is can be endlessly illuminating. I hope you enjoy this journey of discovery as much as I have.

Why is there so Much Buddhism in my Zen Book?

The title of this section, “Why is there so Much Buddhism in My Zen Book?”, is mostly tongue in cheek. Zen is a school of Mahayana Buddhism, so anything written about Zen is, by definition, also writing about Buddhism and vice versa. What I am subtly making fun of with the title is the idea that basic “Buddhism 101” type teachings are “Theravada”, and thus either not relevant or perhaps even contradictory to the teachings of Zen. This is an inaccurate view. First of all, the foundational teachings of the Early Buddhist Texts are found in both the Theravada and Mahayana traditions. These foundational early Buddhist texts (Agamas and the Pali Canon) are equally a part of both Mahayana and Theravada and contain the core teachings of both.

Secondly, with very few exceptions¹, the differences between Theravada and Mahayana Buddhism mostly lie in their differing supernatural or cosmological beliefs. These beliefs often revolve around ideas pertaining to existence after the physical death of the body and also revolve around the existence of deity-like Buddhist luminaries. The Buddha himself is given an eternal cosmic deity-like gloss in some Mahayana teachings. If you look past these supernatural or cosmological beliefs, the core teachings are almost completely compatible between the two schools of Buddhism. Generally, Mahayana teachings are elaborations of the core teachings found in Early Buddhist Texts. There may be differences between some of the practices in Theravada Buddhism and Mahayana Buddhism, but there are equally big differences in the practices within Theravada Buddhism and Mahayana Buddhism themselves.

Given that many Mahayana teachings are elaborations of the teachings in the Early Buddhist Texts, it can be very difficult to fully understand some of the more sophisticated or subtle Mahayana teachings without understanding the Early Buddhist teachings they are built upon. When I see Zen

¹ The nature of Svabhava (own-being) is one example.

practitioners going off the rails (which is especially prevalent among online commentators), it is usually a symptom of their ignorance of some basic tenets of Buddhism. A basic understanding of Buddhism puts the “PhD” level Mahayana and Zen teachings in perspective. For example, in the study of Physics, you can’t really understand high level concepts like quantum mechanics or special relativity if you don’t first grasp the fundamentals of Newtonian physics. The same dynamics hold true for Buddhism. For example, you cannot truly understand the Mahayana concept of *sunyata* (emptiness) unless you first understand the Early Buddhist teachings of *prapanca* (dualistic conceptualization) and *anatman* (non-self) first.

Also, in the particular case of this book’s investigation of the neuroscientific basis of the human condition and liberation, by necessity we must have a comprehensive survey of all levels of Buddha’s teachings if we want to have a complete picture of how it all fits together. From the five aggregates to the teachings of awakening and emptiness, this book endeavors to tell a comprehensive story about how humans process reality, why we suffer and what the solution to that suffering is.

INTRODUCTION

One of the core teachings of Buddhism is that humans suffer when they cling to unfulfilled goals and expectations. The problem is not that we have goals and expectations; it's the grasping at these goals and expectations when life does not unfold how we want it to. To help illustrate this teaching, let's look at some concrete examples. The following are three scenarios where someone encounters suffering due to life not turning out how they expected it to.

Let's first look at Laura. Laura is 18 years old and in the last year of high school. Unlike a lot of her peers, she has always been highly motivated in school and has always known what she wanted to do "when she grew up." She knows with a strong certainty that she wants to be a high-powered attorney and when that goal is accomplished, she is certain that she will be able to live a prosperous and fulfilling life. She has a vision of herself as an incredibly smart, capable person who holds a lot of appeal for others. She is confident in herself and the inevitability of her future success. With this confidence motivating her, she applies to a number of prestigious colleges. With a high GPA, an impressive SAT score, meaningful volunteer experiences, glowing recommendations and a well written personal statement essay she is certain of getting acceptances from most if not all of her target schools.

However, the unimaginable happens. When the responses from the schools she applied to start trickling in, she is horrified and dismayed to discover that she was rejected by each one. She was even rejected by her "safety" college that she felt was beneath her. It turns out there were thousands of other high achievers who applied for too few spots, and she had enough bad luck that she was not selected from among all the other excellent candidates. She is absolutely crushed as a result. Her sense of self-worth has imploded, and she experiences a profound psychological hit like she has never experienced before. Her future went from bright and hopeful to

bleak and uncertain in a flash. Months later she is still despondent and emotionally crushed. She can't seem to break free of the thought that her future is bleak and without hope.

Now let's look at a scenario involving someone we will name Sandeep. Sandeep is 36 years old. He has just discovered a hard lump in a location of his body that should not have a hard lump, and he begins to feel terrified. His future instantly seems dark and sinister. He looks down at his 5-year-old playing with his toys.

"Am I not going to be here for him as he grows up?", he asks himself.

Weeks go by and he has not found the strength to make a doctor's appointment. The reality that he may have cancer is just too painful of a possible reality to even touch. At the same time, he knows that if it is cancer, he is playing a dangerous game by not acting quickly. He can't afford to wait. Yet he is. His future seems scary and uncertain, and he just can't find the strength to face it. He cannot believe it might all come crashing down like this. How can he even move forward?

Lastly, let's look at Malcom. Malcom is 56 years old and life has been good. His kids are in high school and doing well. His career has been a success and overall, his health is decent. He looks over at his husband and thinks about how much he loves him and how lucky he is to have him in his life. His husband feels his gaze and looks over at him. To his surprise, the look back from him is icy and indifferent. His husband sighs and comes over to talk to him. Malcom's spouse decides that now is the time to tell him that he has fallen out of love and wants a divorce. In fact, he has started dating someone else and perhaps it would be best if Malcom moves out sooner than later.

This scenario understandably turns Malcom's world upside down. He has known emotional pain before in his life, but nothing like this. This is an emotional agony that he would not have felt was possible. He feels like a piece of him is being torn from his very being. This feels worse than death. A year later he is formally separated from his husband, and he has finally started climbing out of the deepest chasm of his depression. Getting out of bed in the morning is slightly less impossible, but he is still devastated. He cannot believe how quickly and completely his life has fallen apart. He passionately yearns for his life to go back to how it was. It feels as if he lives in a narrow gray tube with no sunshine and no real hope for the future. He is just a shell of his former self.

Grasping at Unmet Expectations

Let's now look at each of these three scenarios in turn to examine the unmet goals and expectations. Laura's unmet expectation was to get into a good school. Sandeep's expectation was to be healthy and be there for his children. Malcom's expectation was to have a loving and ongoing relationship with his partner. These are all reasonable and wholesome expectations to have, but unfortunately life has a way of frequently dashing our expectations. When this happens, we often fall into dissatisfaction and suffering. The depth of this suffering is proportional to how consequential an expectation is. The greater the consequences, the greater the suffering. For example, dropping your sandwich on the ground might only bring mild annoyance for a short amount of time but if you are like most of us, suddenly being fired from a cherished job will likely lead you to a prolonged period of worry and rumination.

Due to how deeply we grasp at high-stakes expectations and the inevitable unpredictability and dynamic nature of life, most humans spend too much time lost in this type of suffering. Even if someone has been fairly lucky and has avoided any serious setbacks in life, the specters of old age, sickness and death are awaiting them with life's greatest tests.

Liberation

Another fundamental teaching of Zen Buddhism is that there is a solution to this dilemma. It is verifiably possible to change the way our brain processes and resides within reality in a manner that greatly reduces and possibly even eliminates psychological suffering in our life.

The central thesis of this book is that psychological suffering is transcended when the mind stops turning ordinary experience into graspable, self-referential entities. The brain normally uses memory and prediction to construct a continuous sense of self and to give people, objects, goals, and events stable "own-being" identities that extend across time. Through dualistic conceptualization, these representations become embedded in narratives about what they mean for us in terms of pleasure and survival, which allows desire to become craving, unmet expectations to become grasping, and unwanted experiences to become aversion. Mindfulness can interrupt this process temporarily by redirecting attention away from self-referential mental time travel and back toward present-moment experience, while

sustained meditation can make this mode of processing increasingly stable and effortless.

At the deepest level, liberation comes through directly realizing the emptiness of “own-being” of what we are perceiving. This ensures that ordinary perception, recognition, reasoning, and action can continue without the mind treating the self or the objects of experience as fixed, independently real entities that become clingable due to self-referential stories that we become uncontrollably fixated upon. In this model, awakening does not require the elimination of perception or the cessation of thought but rather it manifests through the transformation of the way experience is normally constructed as fixed and continuous. When we awakening to fundamentally timeless nature of the mind and apprehend our true nature the process of integrating this wisdom into our lives can begin. This book is an exploration of the science behind this entire process.

Scope of this Book

Zen Buddhism has many facets and dynamics, and without question science is out of scope when discussing many of them. This book does not endeavor to or claim to be a complete explanation of the human experience or a complete explanation of the functioning of the Zen Buddhist path. There are many aspects of the experience of being a human that science simply does not have the answer for. For example, science does not even come close to an explanation of how consciousness emerges. There are also many specific elements of Buddhism that are simply not observable or quantifiable. Specifically, anything involving life after death or general cosmological matters are far outside the scope of this book.

The areas that science does have the tools and perspective to explore and thus are in-scope for this book are: why and how humans have a perceived sense of self, why that sense of self causes us to suffer, how meditation and other Zen practices work on the brain to alleviate suffering and what the nature of awakening in this lifetime might be.

Structure of this Book

I write this book from the perspective of a Zen practitioner and teacher who wants to use what we can learn from neuroscience to illuminate the how the mind works, why this functioning can cause us to suffer and what the solution to this suffering is. I am not a neuroscientist, but rather a systems

engineer and I approach this book from that angle. My work in computer science, artificial intelligence and engineering has nurtured my ability to envision complex systems and explain their mechanisms in an understandable manner. That is my goal here. The matrix of Buddhist psychology is quite complex, and I hope to make its mechanisms understandable by mapping it to what neuroscientists can teach us about human cognition. The book is organized into four parts that tell this story of perception, self, suffering and awakening.

Part 1 – Body and Mind

First, we will explore why brains evolved and how their role in survival has shaped the way they perceive and interact with reality. We will look at how the brain represents both the organism and the world around it, makes predictions about what is happening, and uses rewarding and punishing feelings to influence behavior. From there, we will introduce the Buddhist five aggregates as a framework for understanding some of the basic processes involved in ordinary human experience. We will examine how the brain creates the experience of having and being a body, how feeling tones give experiences a pleasant, unpleasant, or neutral quality, and how perception allows us to recognize and categorize what we encounter. We will then look at decision making and how habits, subjective value, self-referential information, and predictions about possible outcomes contribute to the choices we make. Finally, we will explore differentiating awareness and how sensory information becomes organized into distinct objects and phenomena within conscious experience. Together, these chapters give us a working model of how a survival-oriented brain constructs the meaningful world we ordinarily experience.

Part 2 – Self, Other and Desire

Next, we will explore how these basic cognitive processes contribute to our experience of being a self living in a world of identifiable people, objects, events, and possibilities. We will begin by breaking the apparently unified experience of self into a number of different processes, including the experience of having a body, occupying a particular point of view, persisting through time, making choices, having an identity, relating to other people, and experiencing life as an ongoing story. We will then examine *prapañca* (dualistic conceptualization) and how the mind generates self-referential beliefs, judgments, and predictions about what the things we encounter mean to us. From there, we will explore *svabhāva* (own-being) and why mentally represented people, objects, events, and concepts can seem to possess stable identities of their own, especially when memory and prediction connect them across time. We will then look at attention and how the brain

determines what becomes prominent in conscious awareness, including the competition between present-moment experience and self-referential mental activity. Finally, we will explore *chanda* (desire), distinguishing habitual wanting from goal-directed desire and examining how incentive salience, anticipated reward, and decision making motivate us to pursue particular outcomes. At this point, these processes are still largely adaptive and necessary for successfully navigating life.

Part 3 – The Causes of Suffering

We will then explore how these useful cognitive processes can become the source of psychological suffering. We will begin with *taṇhā* (craving) and examine how ordinary desire can become an uncontrolled self-referential preoccupation with the anticipated pleasure or survival importance of attaining a goal. We will then turn to *upādāna* (grasping) and look at what happens when those expectations collide with reality, producing prediction errors that the mind repeatedly revisits through disappointment, worry, uncertainty, and other forms of repetitive negative thinking. From there, we will explore *dveṣa* (aversion) and the rejecting side of this system, including anger, fear, threat responses, rumination, and the ways imagined future dangers can prolong physiological and emotional stress. Finally, we will examine *dukkha* (suffering) itself. We will look at its different forms, why physical and emotional pain evolved, and how the brain produces the subjective experience of each. We will then ask what distinguishes unavoidable pain from the additional self-referential suffering described in Buddhism as the “second arrow,” and we will examine a proposed neurological circuit through which the default mode network may generate sustained emotional pain.

Part 4 – The Solution to Suffering

Finally, we will explore the practices and transformations that Buddhism proposes as a solution to suffering, beginning with changes that can happen immediately and moving toward the deeper transformations associated with liberation and awakening. We will start with mindfulness and examine how skillful control of attention can keep us in present-moment experience, interrupt mental time travel, attenuate narrative self-processing, and temporarily stop the grasping activity that sustains suffering. We will then turn to meditation as a broader form of mind training and explore meditative tranquility, *samādhi* (meditative absorption), alterations in different dimensions of selfhood, focused attention, open monitoring, *kōan* practice, embodied Zen practices, and the development of increasingly effortless attention. From there, we will look at what happens when the effects of practice begin to persist outside individual meditation sessions, including increases

in trait mindfulness, resilience, equanimity, and changes in brain structure and functional connectivity associated with short- and long-term practice.

We will then explore the liberated mind itself and examine Buddhist descriptions of nirvāṇa (liberation) as timeless, free from graspable objects, free from suffering, and free from greed, hatred, delusion, and conceptual duality. Next, we will examine Buddha-nature through teachings on Mu, not-knowing, freedom from conceptualization, the Unborn, emptiness as the absence of own-being, decentering, and the luminous or numinous quality of awareness. Finally, we will explore awakening itself, including the destruction of the intoxicating survival drives, prajñā (liberating wisdom) as the realization of emptiness and nonduality, possible mechanisms of sudden awakening, the cultivation that may be required after realization, and the continuous actualization of awakening through practice and everyday life.

Part 1 – Body and Mind

1 - LIFE, THE BRAIN AND SURVIVAL DRIVES

In this chapter we set the stage for the rest of the book by looking at why brains exist and what their fundamental role in a living organism is. This gives us the context needed to investigate the mechanisms that we will encounter as we explore why humans suffer and what can be done about it.

Against the Tide of Entropy

We often take it for granted because it is so ubiquitous, but the very existence of ongoing life on this planet is an incredible phenomenon. Our planet is covered with trillions and trillions of mind-bogglingly complex living organisms. It is remarkable that the first lifeforms were not just a one-shot fruition of complexity that sputtered out into entropy as quickly as they came to be. The second law of thermodynamics would seem to suggest that the long-term stability of such complexity of matter is highly improbable and normally would not exist in an ongoing manner due to entropy. This long-term persistence of life against the pull of entropy is entirely possible due to the design and functioning of a chemical structure known as DNA. To clarify quickly, note that when I use phrases like “designed by evolution” in this book, this is a shorthand for “shaped by evolution”.

DNA and Cells

The living things on this planet seem to be designed with an almost single-minded focus of perpetuating the existence of life itself. Living organisms are highly focused, from a design perspective, on creating new copies of themselves and in maintaining their own structural integrity long enough to do so in an effective manner. The main driver of the strategy and

implementation of this design is an astonishing chemical structure known as “deoxyribonucleic acid”. These incredibly complex DNA molecules are the blueprints of how life is built and how it functions. This molecule is the heart of what life is and assumes the dual role of being both the instructions on how to create and operate a life form and also being a key part of the machinery to actually manufacture that life form. Everything that an organism is and everything an organism does is because of the instructions contained in DNA. Even our ability to adapt and change comes from programming inside of DNA.

The living organisms on our planet are either single cell or multi-cellular organisms. In each of these cells is where we can find DNA. These molecular instructions are tightly packed within the cells into structures we call chromosomes. We can think of a cell as a tiny self-contained factory and the DNA as the master blueprint vault in the central office of the cell. Each cell keeps a complete copy of the blueprint for the entire organism regardless of if it is composed of one cell or many.

In multi-cellular organisms, different cells will have specific jobs, and DNA is sophisticated enough that it only reads and uses the instructions in sections of itself relevant to the particular job of that specific cell and its function. A skin cell, a neuron, a muscle fiber are reading and functioning from the same chemical DNA library, but each is using different “chapters” of the DNA at different times.

The way DNA does anything is by directing the construction of proteins. Sections of DNA called genes are essentially recipes for building specific protein molecules. The cell copies a gene into a temporary working document made of RNA, which then can leave the nucleus and travel to the protein-building machinery in the cell’s cytoplasm. There, complex molecular machinery called ribosomes read the RNA instructions and assemble amino acids in the correct order to form a protein. These proteins then become the structures, moving parts, sensors, and the control switches that make the entire organic system function.

In the context of multicellular organisms, DNA not only controls which proteins are made but also where and when. It doesn’t just say what to build, but also when to build it and how much. The strands of DNA are lined with chemical switches and control panels that respond to both internal and external conditions. These conditions are signals from other cells, levels of nutrients, stress, light, temperature and more other factors. These signals cause certain genes to be turned “on” or “off,” changing the behavior of the cell. In this way, DNA helps coordinate trillions of cells in

multicellular organisms, so they don't behave as isolated factories, but as cooperative units in one integrated, self-maintaining organism.

DNA also ensures that these cellular factories can reproduce and repair themselves. Before a cell divides, it carefully duplicates its DNA, copying billions of chemical "letters" with astonishing accuracy. This allows the instructions to be passed on to the next generation of cells, preserving the design of the organism over time. When damage occurs—because of radiation, toxins, or random chemical accidents, specialized repair proteins in the cell patrol and fix many of the errors. This constant cycle of copying, checking, and repairing allows the organism to remain functional for decades, even though individual parts are being recycled and replaced constantly.

Evolution

Initially, all forms of life on earth were composed of individual cells and in fact, scientists believe that all currently living organisms are the descendants of one particular single individual cellular organism that lived billions of years ago. If the scientists are correct about this, then that means all life forms are literal relatives of each other. All currently living organisms ranging from humans, horses, sea sponges and redwood trees are literal cousins of each other. You might go further and say that all life is actually the same organism that is continually replicating itself into separate instances over and over again. From that point of view, there is just one organism that is spreading across the planet, and any one individual instance of that lifeform is just a temporary carrier of the DNA core that constitutes the actual lifeform. Whether all life are cousins of each other or whether it's the same life form with physical continuity as individual instances depends on your point of view. Either way, all life has deeply ingrained connections with all other life.

Whether you conceive of individual life forms as cousins or just instantiations of one life form, either way it is reasonable to wonder how each single instance of life can be so different from other ones around it. If they had the same starting point, why is a redwood tree so different from a sea sponge? The answer is: evolution. Evolution is the mechanism in which each generation of life might change its physical structure and behavior of an organism to better ensure survival and procreation. It is a two-step process that allows for the creation of the myriad types of lifeforms that have ever lived on this planet. The first step in the process is mutation and the second step in the process is natural selection.

The first step works through the DNA copying process. When DNA replicates itself to create a new instance of an organism (or a cell in the part of a larger one), it must duplicate itself so there is a copy of the DNA first. As it turns out, DNA copying is an imperfect process. For various reasons, the copied DNA can be subtly different than the one it was copied from. Since DNA contains both instructions on how to build cells and how those cells function, the new DNA might alter how a cell is structured or functions. Sometimes the changes produce no noticeable changes in either structure or behavior and sometimes it can produce dramatic changes. In the case of single cell organisms, each splitting of a cell and the associated DNA copying is an opportunity for mutation. In multi-cellular organisms that use an egg and sperm mechanism, the cells that create the eggs and sperms are cells where inheritable mutations can occur.

The second step of the evolution process is fitness. All organisms have specific physical properties and behaviors that result from the programming in their DNA. These physical properties and behaviors can be neutral, negative or positive in terms of how they affect the survival and reproduction success of an individual organism. If the current state of an organism is conducive to survival and procreation (i.e. it has fitness), the underlying DNA is more likely to get copied and passed to a new generation. If mutations in DNA hurt its chances, it has less fitness and the chances of that DNA continuing on are decreased.

An example of this might be a certain DNA configuration that makes a moth's wings the color gray. If that gray color matches the color of the local trees, that will help the moth hide from predators. Let's say that through climate change a new type of brown barked tree becomes dominant in an area. The gray-winged moths would now be more vulnerable to predation. If, however, some moths have mutations that make their wings brown, they would have better fitness for their environment since they would be less vulnerable to predation. Over time you would have fewer and fewer gray moths and more and more brown ones. This is evolution in action.

All species have a "survival strategy". This is the combination of physical attributes and behaviors that make an organism less or more fit for their environment. Based on the current understanding of science, survival strategies all stem from random and accidental mutations. One of the most successful developments of these randomly occurring survival strategies has been the existence of brains.

Brains

There are various high-level classifications of life on earth. The highest-level classifications of living things are Bacteria, Archaea and Eukarya. Bacteria and Archaea are types of single celled organisms and Eukarya are a large mix of single and multicellular organisms. One classification in Eukarya is the kingdom Animalia (Animals). Animals can be subdivided in different ways but for our purposes we will divide them into three categories:

- Animals without central nervous systems
- Animals with central nervous systems
- Animals with central nervous systems during certain phases of their lifecycles

Most animals in the “without central nervous systems” category are sea sponges. Examples of animals with central nervous systems are humans, lobsters and skunks. An example of an animal that has a central nervous system during just one phase of its life is the sea squirt.

Nervous systems are based around a type of cell called a neuron. Neurons are a specialized type of cell that excel at coordinating fast-paced behavior of an organism. This behavior usually involves eating, fleeing or mating. So, if an organism has multiple cells and needs to move in some way when eating, fleeing or mating, it is going to need a central nervous system. Compared to the nervous systems of many animals, some nervous systems are extremely simple. For example, a jellyfish has a quite simple and diffuse nerve network that focuses on simple environmental perception and the contraction of tentacles. This would be an example of a species that has a nervous system but not a fully developed brain.

Other species have slightly more complex nervous systems that include something called ganglia. Ganglia are clusters of nerves with specific roles. For example, in an earthworm there are ganglia for perception and locomotion. Jellyfish also perceive and make movements, but the survival context of an earthworm is more complex, so it needed to level up its neural complexity to deal with more sophisticated perceptions, decisions and movements. The delineation between types of animals that get by with simple nerve nets vs ganglia is based around body shape. Animals that are radial (body parts arranged around a central axis) can get by with simple nerve nets. Animals that are classified as bilateral (left and right sides are mirror images) are more complex and need at least the complexity of ganglia to implement their survival strategies.

As the survival strategies of certain species became more complex, eventually there came to be an evolutionary necessity to develop brains. Most bilateral animals have heads, and it is in these heads that brains were developed. While ganglia are mostly specialized relay stations, brains are full-on centralized control centers for the entire organism. Even the simplest brains are incredibly complex and organized so that they can facilitate flexible and sophisticated perception and movements in the organism that hosts them.

The third classification of animals that we will look at is ones that start off their life with a central nervous system but lose it later on. We mentioned that one example of this type of organism is the sea squirt. Sea squirts get their name from their ability to "squirt" water when disturbed. Sea squirts typically live most of their lives as attached and non-moving filter-feeders. Its lifecycle is interesting due to its dramatic transformation: it begins as a free-swimming tadpole-like larva. This larva is designed to swim around until it finds a suitable spot to settle. Once it has located an appropriate spot where it can live, it undergoes a radical metamorphosis: It attaches itself to an object and reabsorbs its tail along with its entire brain leaving behind a cluster of nerve cells for some basic biological functions. This "loss" of the brain is a remarkable adaptation. Once it is settled as an attached adult, the complex sensory and movement functions enabled by the larval brain become unnecessary for a creature whose sole purpose is to filter feed from a fixed position. Brains are "expensive" from an energy expenditure perspective, and by getting rid of its brain, the sea squirt increases its chances for survival.

The lifecycle of the sea squirt perfectly illustrates the purpose of a brain: perceiving the environment and moving around. An organism that does not perceive the environment, makes decisions and move around does not need a brain. Once the sea squirt no longer engages in all three of those activities, the brain is no longer needed. This is a key point to understand in this book. Brains exist to create cognitive representations of an organism itself and the world around it based on information that comes in through the various senses. Simple organisms have correspondingly simple neuronal representations of "self" and "other" and typically make relatively simple decisions on how to interact in a world of these "others".

Brains as Prediction and Inference Machines

Let's say you are walking down the street, and you see a bear holding an unlit Star Wars style lightsaber. You are not totally surprised to see a bear since you saw one nearby yesterday. The lightsaber is a bit odd though.

Since you see yourself as a protector, you don't run away from the bear and instead stick around to see if anyone needs your help. While you are standing there you see a baseball come flying out of a little league baseball field from across the street and head right towards you. You are able to easily track its trajectory and sidestep it before it reaches you.

This strange little scenario is a great illustration of what your brain does best: make inferences and predictions. Let's take a look at some of the inferences and predictions that were involved in processing this scenario:

The first inference the brain makes is that it does not see two large holes in your field of vision. We all have large gaps in our vision where our optic nerves attach to our eyeballs. At those spots on the retina, where the optic nerves exit the eyes, there are no photoreceptors to detect light. Yet we do not normally see holes in our visual field because the visual system fills in the missing information using the surrounding visual context. We don't see those blank spots in our field of vision because our brain predicts what would be seen in those spots and fills in the missing information based on the patterns of light in the general area.

The next inference is your perception of the bear holding a lightsaber. Your brain has an internal model of what a bear looks and acts like. You also have an internal model of what lightsabers look like and how they are used. Also, since you saw a bear in the area, your mind was unconsciously predicting that there is a reasonable possibility of seeing one again. You had also just watched Star Wars yesterday, which helps your mind predict lightsabers.

It turns out it was not a bear that you were seeing at all but rather just a man bundled up in brown winter clothing and he was holding a flashlight. Your brain realized its mistake almost instantly but for a split second your brain really did think it was looking at a bear holding a lightsaber. Your brain initially took what information it had about the shapes and colors it was seeing and the context it was seeing them in and quickly made an inference on what it was. It filled in the blanks, and your brain saw a bear and a lightsaber. It predicted incorrectly but it was a prediction, nonetheless.

The next inference you had was the trajectory of the baseball. Based on your knowledge of gravity, the nature of how baseballs behave while in flight and general visual tools that your brain has, you were able to predict where it was heading and move out of the way.

The last prediction we can talk about is your view of yourself as a protector. Based on your past experiences of life you came up with a narrative of who you are and what your relationship is to other people. This is an

inference about who you are, and that self-model helps generate predictions about how you will behave and how different situations will make you feel. Like all predictions it is a prediction based on memories and an expectation based on what you are sensing in the present.

All these inferences and predictions illustrate a key way the brain processes reality. It would be impossible to live life without constant inferences based on past learning. Imagine having to learn in excruciating detail what a toilet was, what its purpose was and how it worked every time you encountered one. Life would grind to a complete stop without predictions and inferences.

Going back to the scenario of the bear, there are two additional concepts we can learn regarding how the brain works when it makes predictions. The first thing to note is that the brain is often wrong about its predictions. For example, someone with social anxiety is probably constantly predicting wrong about what people think of them and how social situations will play out. The other thing to note about the bear scenario is that the brain's inferences about reality are not a one-shot deal. When the brain makes an inference based on memories and/or sensory information, it does its best to complete its perception by filling in incomplete details. As the brain gains new information it constantly updates its internal representation of what it is seeing. Brain inference is an ongoing and iterative process.

As we explore the ideas in this book, we will see again and again how the inference and prediction design pattern occurs in the brain and influences how it functions. From visual perception to experiencing an illusion of self, the brain is constantly inferring reality based on what it is perceiving and what it has learned.

Survival Drives, Feeling-based Rewards and the Asavas

Pretty much by definition, DNA has what one could conceptualize as a "survival drive" built into it. If it didn't have programming that revolved around its ability to keep a host alive and then help that organism produce offspring, it would have existed for exactly one generation and we would not be here right now to think about it. Through evolution, traits that allow an organism to survive and reproduce are highly selected for. For the purposes of this book, we will focus on the survival drive traits that manifest as "felt" cognitive motivations that exist to influence our behavior. These motivating survival drives largely exist to motivate behaviors pertaining to survival and procreation.

In order to survive, an organism has to maintain homeostasis. Homeostasis is the process by which living organisms maintain stable variables in their internal environment that keep them alive. Examples of these variables are body temperature and blood sugar levels. The process of homeostasis seeks to maintain these variables within acceptable ranges despite changes in the external environment. It is a dynamically maintained state of stability that is necessary for survival and proper bodily function. It is a two-step process of first sensing the status of the variable's states and then engaging in action to keep the values within range.

Taking the blood sugar variable for example, if our body senses low blood sugar we will feel a "punishing" felt sense of unpleasantness that motivates us to act in ways to increase our blood sugar. If we are cold, we will experience unpleasantness that motivates us to engage in actions like covering ourselves with more clothes or moving to a warmer location. When we engage in these activities to regulate our homeostasis, we are then rewarded with pleasant sensations.

This brings us to the key Buddhist concept we will explore in this book: The *Asavas*. *Asavas* are translated with a bewilderingly large number of terms such as inflows, influxes, fermentations, outflows, cankers, taints and corruptions. To get at a core definition of the term, I think it helps to look at the etymological use of "*asava*" in ancient India. In that context it means essentially, "fermented beverage". That is why some people translate it with the term "fermentations". If we look at the usage of *asava* in context though, it is referring to something that affects us, so I think the correct contextual translation would be "intoxicant". It is a felt survival drive that "intoxicates" us and influences our behavior. "Intoxicate" also has the implication of something that changes our behavior in a way outside of our volitional control. Since "intoxicating non-volitional survival drives" or something like that would be too cumbersome, we will often use "intoxicating survival drive" or just leave "*asavas*" untranslated in this work.

Depending on the Buddhist text there are said to be either three or four types of *asavas* and we will look at two of them here. The first type of *asava* that we will look at is called "*kamasava*". *Kama* is translated as "sensuality" but not just sensuality in terms of sexual intimacy, but rather any pleasant sensation. As a survival drive, our behavior is influenced by *kamasava*: we are strongly motivated by the drive to seek pleasant feelings. This is a core human motivation that fundamentally shapes our experience of life. It is so ubiquitously present from our earliest experiences of existing that we are often hardly even aware of it despite it dominating our motivations,

thinking and behavior. It exists as “rewards” designed by evolution to motivate us to engage in behavior that is conducive to survival and procreation.

The second type of asava that we will look at is *Bhavasava*. *Bhava* means “exist” or “existence”. It is the mental motivation to survive and continue existence. Many animals seem to have this survival drive on some level. When a lion chases a gazelle, the gazelle will have a strong inclination not to get attacked and a rush of fear and adrenalin will push it to flee and evade capture. Humans have the same neurological survival mechanisms but have an additional level of survival drive since we can conceptualize the concept of death. We can conceptualize existence and also conceptualize non-existence. It is an open question whether we are the only animal that has this. There are indications that other animals can recognize the deaths of others. They can seem to recognize that other bodies can permanently lose animated mobility. We especially find this capacity in long-lived, social, and cognitively complex species. There is also some indication that some species have a sense of their own separate individuality. Whether they can put these two concepts together and recognize their own mortality is an open question. Regardless, humans are certainly aware of their mortality and along with the drive to experience pleasant rewarding sensations, our behavior is fundamentally influenced and directed by this core asava motivations. We will explore how this contributes to suffering later in this book.

2 - INTRODUCING THE FIVE AGGREGATES

As we have seen earlier in this chapter, the core function of an animal's brain is to create internal representations of the organism that hosts it and then internal representations of the world around the organism. Once these representations have been created, a brain can then process these representations to determine the best way to interact with the world in order to maximize survival. This design is highly developed in humans. Our brains create a sophisticated and multilayered sense of self that has the capacity to make extremely complex and nuanced decisions about how to move about and interact with the world. These decisions are driven by an underlying drive to survive and experience feeling-tone rewards for behavior that the brain thinks are conducive to survival.

The Buddha was an astute observer of the human mind and recognized that it could be divided into five fundamental activities or capacities. He called these five capacities the "five aggregates". When we look at how these mental activities work together as an aggregated system through the lens of science, we can see that they represent the core functioning of conventional human consciousness as it works to process reality and make behavioral decisions.

These functions are:

- **Rupa (Body/Form)** - The sense of having and being a body
- **Vijnana (Differentiating awareness)** - The capacity to be aware of and mentally represent objects and phenomena through the senses in a subjective manner.
- **Vedana (Feeling Tones)** - The ability to experience objects and phenomena as being pleasant or unpleasant to interact with.
- **Samjna (Perception)** - The ability to recognize and categorize objects and phenomena.

- **Samskara (Decision Making)** - The capacity to make decisions on how to interact with these objects.

Aggregated together, we can see that these five capacities represent how we perceive the world around us and then how we decide how we are going to interact with it. It is the experience of having a body that hosts a mind. A mind that can perceive, analyze and interact with the world. From the perspective of conventional reality, this perception and processing of reality happens within the experiential context of self-identification. A conventional sense of self is intrinsically linked to the existence and workings of the five aggregates.

This concept of five aggregates is one of the foundational teachings in Buddhism and many of the scriptures, literature and teachings of Buddhism in general and Zen in particular presuppose an understanding of what the five aggregates are. As an example, let's take a close look at the Heart Sutra. The Heart Sutra is arguably the most important text in the world of Zen Buddhism, and it is a good example of the centrality of the five aggregates in Buddhist teaching. "Sutras" are texts that purport to capture the teaching dialogs of the Buddha and his disciples, and the story of the Heart Sutra takes place in a location that was known as "Vulture Peak" in ancient India. Many Buddhist monks were present at a gathering there to meet with the Buddha and practice with each other. The events of Heart Sutra revolve around recounting a dialog between two of these monks. The first Monk is named *Śāriputra*. He is well known as one of the preeminent disciples of the Buddha and is esteemed for his deep wisdom. The second monk in the story is *Avalokiteśvara* who was a Mahayana Buddhist monk. The story starts off with *Avalokiteśvara* sitting deeply in meditation where he perceptually apprehended that the "Five Aggregates" had no inherent and independent reality and thus relieved all suffering. After this spiritual apprehension, he then expounds a teaching on this subject that is directed to the monk *Śāriputra*. Part of this teaching is the following:

Śāriputra, form does not differ from emptiness, emptiness does not differ from form. Form itself is emptiness, emptiness itself form. Feeling-tones, perception, decision making, and dualistic-consciousness are also like this. Shāriputra, all dharmas are marked by emptiness; they neither arise nor cease, are neither defiled nor pure, neither increase nor decrease. Therefore, given emptiness, there is no form, no feeling tone, no perception, no choice, no dualistic consciousness...

We will discuss in detail later what is meant by “emptiness” but for now what is most important to note is that, in what is essentially the central defining manifesto in the Zen tradition (the Heart Sutra), it references our relationship to the five aggregates in its primary thesis. The Heart Sutra contends that seeing clearly through and then transcending these five aggregates is the primary way of attaining liberation. The phrase “Five Aggregates” is mentioned constantly by the Buddha in the Buddhist sutras and is commonly found in subsequent Buddhist elaborations including Zen.

Aside from their importance in categorizing human cognition, they are also seen as representing the conventional human perception of individual self-identification. For example, in the *Vajirā Sutta* (“A Discourse with Vajira” - SN 5.10), the Buddha makes the statement:

“So, when the aggregates exist, there is the convention: ‘a being.’”

Another example is found in the *“Sakkāya Sutta”* (“Identity Discourse” - SN 22.105) where the Buddha states:

“And what is identity? It should be said: the five grasping aggregates. What five? That is, the grasping aggregates of form, feeling, perception, decision making, and dualistic consciousness. This is called identity.”

Another sutta where this is made explicit is the *“Culavedalla Sutta”* (“The Shorter Elaboration Discourse” – MN 44):

Then the layman Visākha went to see the nun Dhammadinnā, bowed, sat down to one side, and said to her, “Ma’am, they speak of this thing called self-identification. What is this self-identification that the Buddha spoke of?”

“Visākha, the Buddha said that these five grasping aggregates are self-identification. That is, the grasping aggregates of form, feeling tones, perception, decision making, and dualistic consciousness.”

An often-used synonym for the “five aggregates” in the suttas is the phrase “name and form” and this nomenclature is further evidence of the tight correlation between the five aggregates and a sense of individual

identity. The “form” component of this phrase is referring to our physical bodies and “name” represents our mental faculties that perceive and process reality. In the spiritual dialogue of the Buddha’s time, “name” represented our individual identity. For example, we can find the following excerpt in the *Bṛihadaranyaka Upanishad* which is a good representative of the foundational spiritual philosophy of the Buddha’s time:

“At that time this [universe] was undifferentiated. It became differentiated only by name and form, so that one could say: ‘He has such a name and such a form.’ Therefore, even today this universe is differentiated only by name and form.”

When the Buddha was teaching his contemporaries, he was speaking to an audience that understood “name and form” to mean our “body and self-identity”. Much of his teachings regarding this identity revolved around enumerating the five aggregates that he felt represented the main cognitive processes involved with perceiving, representing and processing reality. In this book, we will see how the functioning of the five aggregates is involved in determining how to most effectively interact with the world and investigate how this cognitive activity happens within the context of a conventional sense of self-identification. In the next few chapters, we will look at each of these five aggregates in more detail.

3 - BEING EMBODIED (RUPA)

Imagine you are spending a nice brisk winter day taking a nice stroll through an apple orchard out in the country. As you are walking through the orchard you notice many aspects of the experience through your senses. For example, you can feel the temperature of the air on your skin, and you can see all the colors and shapes of the trees around you. You can smell the natural aromas around you, and you can hear the sounds of a creek off in the distance. In the midst of all this external sensory information, there is the steady background experiential context of being a body. For example, if your brain is in normal operating mode and you pay attention to it, you will have a clear sense that the feet that you are walking with are part of your body. You will know that the hands that are in your gloves are your hands. You can also feel internal sensations like hunger, soreness or tiredness. Without even having to think about it, you know intuitively that the grass around your feet are not physically connected to you as part of the body. You have a sense of what is your body and what is not. This lived experience is called “*rupa*” in Buddhism and is the first of the five aggregates that we will explore in this book.

In a general and technical sense “*rupa*” is most accurately translated as “form”. It can also be translated as “matter” or “materiality” when defined generally, but in the context of the five aggregates, *rupa* represents our living physical body. As one example of a definition of *rupa* that can be found in the suttas we can look at the *Titthāyatana Sutta* (“Sectarian Tenets Discourse” - AN 3.61), where the Buddha offers this general definition:

*“Supported by the six elements, an embryo is conceived.
When it is conceived, there are name and form.”*

Here the Buddha is saying that at the genesis of life physical elements come together to create a body (form) that combines with a self-aware mind (name) to create a living person. In another sutta called the *Vibhanga Sutta*

(“*Analysis Discourse*” - SN 12.2), the Buddha defines form in terms of its constituent parts:

“The four principal states, and form derived from the four principal states. This is called form.”

In the Buddha’s time, matter was considered to be composed of various permutations of the fire, earth, water and air elements. In our time, we might say physical matter is composed of quarks, electrons, neutrons, etc. From this “component” point of view, the idea of “form” is referencing the physical makeup of the body.

As we noted above, the suttas can also present the idea of *rupa* (form) being the cognitive activity of apprehending the body to be part of one’s self. For example, in the *Nakulapitu Sutta* (*Nakula’s Father Discourse* - SN 22.1), the Buddha talks about how the body is cognized in a conventional (non-awakened) manner:

“They experientially apprehend form as self, self as having form, form in self, or self in form.”

In this context, form is defined as a cognitive sense of feeling as if one is body or owns a body. When viewed scientifically, this experiential apprehension of an embodied sense of self is a combination of three distinct neurological representations. The first is a representation of a body schema which is an internal map of all the movable parts of your body and a general sense of the space that your body takes up. The second component of an embodied sense of self is a “knowing” or self-awareness that your body belongs to you. The third component of “being embodied” is interoception which is the capacity for the brain to sense what is happening internally to the body at any given time.

Body Schema

A body schema is an unconscious, constantly updated neural model of our body’s physical shape and position in space. It is how our brains continuously monitor the location, posture, and movement of our limbs and head relative to each other and the surrounding environment. Our brains maintain this internal predictive model of our bodies in a moment-by-moment manner. This body schema is built from many different types of sensory signals. Examples of these signals are touch from the skin, stretch and

tension from muscles and joints, balance from the inner ear, and visual information about where our limbs are in space. Body schema is why we can touch our nose with our eyes closed or walk without looking at our feet. The brain uses a stream of body information not just to know where the body is, but also to predict where it will be a fraction of a second in the future, which is crucial for smooth, coordinated movement. Earlier we looked at how the brain is a prediction machine and this is one such example. This raw sensory data is processed and mapped primarily in a brain region called the posterior parietal cortex which is the seat of these predictive body processes.

The dynamic and abstract nature of body schema is illustrated by the fact that the brain can include physical tools as temporary extensions of the internal body map. This idea was explored by a team of scientists in Japan led by researcher named Atsushi Iriki in the mid-1990². The experimenters suspected that the brain possesses a highly flexible internal map rather than a rigid blueprint locked to our biological skin. They proposed that this mental map could stretch and change shape to include objects we use as tools, temporarily treating those objects as literal physical extensions of the body itself.

To test this idea, the researchers designed an experiment using macaque monkeys and a simple physical tool. During the experiment, the scientists carefully monitored specific brain cells located in the parietal cortex of the monkeys. These particular cells were targeted during the experiment because they activate under two distinct conditions. First, they fire when a hand is physically touched and second, they fire when an object visually approaches the immediate space right next to the hand. With this neural monitoring in place, the team trained the animals to use a small rake to retrieve pieces of fruit that were placed on a table just outside of what would be their normal physical reach.

The scientists first needed to establish a solid baseline before the monkeys actually used the rakes. They observed how the brain cells behaved when the monkeys were just resting and not trying to grab any food. As the researchers expected, the neurons fired reliably only when a visual object was brought within a few inches of the bare hand. If an object was placed further away on the table, the brain cells would remain completely silent. The brain of the monkey clearly defined its immediate, reachable space as ending right at the physical fingertips.

The results completely shifted the moment the monkeys started actively using the rakes to gather the food. As the animal reached out with the tool

² See (Iriki, Tanaka, & Iwamura, 1996)

to sweep the treat closer, the responsive zone of those exact same brain cells instantly expanded outward. The neurons began firing when an object was brought near the far end of the rake, ignoring the physical boundary of the monkey entirely. The brain was reacting exactly as if the rake had physically grown out of the monkey and become an elongated part of the biological arm.

Based on these experimental results, the researchers concluded that primate brains can rapidly rewrite their physical spatial maps to include the tools we use into our own identity. They also discovered that this mental expansion requires active intent from the user. If the monkey simply held the rake passively as a toy without trying to grab food, the mental map shrank right back to the biological hand. This rapid mental adjustment helps explain how humans can easily swing a golf club or park a car without constantly calculating the dimensions of the object. When we use a tool with a specific goal, our brain temporarily accepts that object as a literal part of our body.

Visual perception plays an important part in how we perceive and map our bodies into a schema. The brain tends to put a lot of trust in our vision, sometimes even more than other senses, and this can actively influence the perceived body model. An example of this is an experiment³ that shows that if a fake but visible hand is stroked in sync with a person's real but hidden hand, many people start to feel as if the rubber hand is their own. That happens because the brain is trying to resolve matching sight and touch and ends up "adopting" the visible object into its sense of body schema. If after we "adopt" this rubber hand a researcher swings a hammer at it, we will likely flinch and withdraw our hidden hand. This shows again that our sense of body isn't fixed, it's a flexible, best-guess construction.

To set up this experiment, a participant sits at a table with one of their real hands hidden from view behind a screen. In front of them, researchers place a realistic rubber hand in a natural position where the real hand would normally be. The participant is instructed to stare intently at the fake rubber hand. The researcher then uses two paintbrushes to stroke both the hidden real hand and the visible fake hand at the exact same time and in the exact same location.

Because the visual information of the brush moving on the rubber hand perfectly matches the physical feeling of the brush on the hidden real hand, the brain experiences an illusion. It struggles to reconcile seeing a touch in one place and feeling it in another when it tries to update its internal

³ See (Botvinick & Cohen, 1998)

predictive model of body schema. To solve this conflict, the brain overrides its internal map and adopts the rubber hand as part of its own body. Participants quickly report a bizarre sensation where they feel as though the touch is actually happening on the fake hand itself.

The thoroughness of this illusion becomes starkly clear when researchers suddenly threaten the physical integrity of the fake hand. If a researcher suddenly swings a hammer or drives a knife toward the rubber hand, the participant will reflexively flinch, gasp, and pull their real hand away in fear as if it were happening to a real hand. Brain scans and other experimental data show that the body reacts with a spike in stress hormones, indicating that the brain genuinely registers the threat to the plastic hand as a threat to its own survival.

We can often get a sense of what different brain regions are in charge of by looking at the unfortunate cases where those brain regions are damaged. That is the case for someone whom the literature has named Patient GL, who suffered a stroke that damaged his posterior parietal cortex, which we identified earlier as the brain region that is in charge of processing body schema. His stroke produced a condition known as autotopagnosia, which is a rare neurological disorder characterized by the inability to locate, point to, or orient different parts of one's own body. People with this disease are even unable to perform these functions when viewing another person's body or even a model of a human body. Individuals with this condition retain the ability to feel and name their body parts, but they lose the spatial understanding of where those parts are situated relative to one another. Essentially, the condition disrupts the brain's internal predictive schema map of the body's layout.

In 2001, researchers Laurel Buxbaum and H. Branch Coslett published a landmark case study⁴ that provided unprecedented insight into Patient GL's autotopagnosia. To determine the exact boundaries of how his stroke damage affected the way he could process body information, the researchers designed a series of visual and spatial tests comparing human bodies to other complex structures. When they showed GL pictures of various animals and asked him to point to their legs, ears, or tails, he did so flawlessly. The researchers then tested him on complex inanimate objects, such as a car or a mug, and he easily located the wheels or the handle. This immediately demonstrated that GL had not lost his general spatial awareness or his ability to understand how smaller parts combine to form a larger whole.

⁴ See (Buxbaum & Branch Coslett, 2001)

The team then introduced an ingenious variation to see if the problem was simply related to recognizing human shapes. They laid out empty articles of clothing, like a pair of pants and a buttoned shirt, on a bed. When asked to point to the sleeve of the shirt or the leg of the pants, GL arranged and identified the items with ease. His brain perfectly understood the structural layout of garments designed to cover the human form, further illuminating that the spatial deficit was strictly related to the biological human body itself.

The most interesting phase of the study involved testing the actual motor functions of the patient against his mapping deficit. Even though GL could not consciously point to his own hand or arm on command, his body reflexes remained completely intact. For example, if a researcher suddenly tossed a ball in his direction, GL would reflexively reach out with his arm and catch it without hesitation. He could use his limbs perfectly to interact with the world, proving that the brain uses entirely different neural regions and networks to physically move the body than it uses to consciously locate its parts.

This study was important because it provided more evidence that the brain maintained a predictive model schema dedicated exclusively to tracking human anatomy. When this specific network, centered around the posterior parietal cortex, is damaged, a person loses the conscious schema of the human form while their ability to move, recognize objects, and map the rest of the physical world remains intact.

Body Ownership

While body schema is largely concerned with where the body is and how it is positioned, another important aspect of “being embodied” is the sense that our bodies are actually “ours”. Similarly to body schema, it seems like it should be inherently obvious what is part of the body and what is not, but it turns out that we need a brain region to explicitly perform this task. This brain region is called the insula. It is the insula that makes a part of your body “feel” like yourself. Problems with one’s insula are a common cause of cases where a person does not feel like one of their body parts belongs to them. One particular study was conducted that showed that the rubber hand illusion we just discussed not only involved the posterior

parietal cortex for body schema but also a brain region called the insula for body ownership⁵.

Building on the mechanics of the rubber hand trick, a University College London researcher named Manos Tsakiris and his team wanted to investigate the neural origins of a sense of body ownership. Researchers already knew the classic setup of the rubber-hand illusion reliably fooled people into perceiving a fake limb as if it were their own. The researchers did not know, however, which specific brain circuits were responsible for generating that specific feeling of body ownership. To find out, the researchers placed participants in a PET scanner to track real-time blood flow and reveal which areas of the brain were most active during the illusion.

The primary challenge of this study was finding a way to filter out irrelevant brain noise. Watching a brush and feeling physical touch on the skin naturally activates various sensory areas of the brain, so the team needed a method to isolate the feeling of ownership from physical sensations of sight and touch. They used a method that measured how much different parts of the brain were being fooled by the illusion.

When the researchers matched the scan data to the strength of the illusion, a specific brain network emerged. The most critical area of this network was the right posterior insula, which is a deep fold in the brain traditionally associated with processing internal bodily sensations like pain and temperature. They also noted significant activity in a neighboring region called the right frontal operculum. The degree to which these brain areas lit up perfectly mirrored the intensity of the participant's perceived body ownership.

The team concluded that our everyday sense of having a body is not a static background perception. It is a continuous and active calculation of what the brain predicts is part of our body. The right posterior insula acts as a central hub that constantly compares what we see, what we feel on our skin, and our internal map of where our limbs are resting in space. When those sensory signals align, this specific brain region generates the perceived certainty that our body belongs to us. It is a predictive model of what is "our body".

As in the case of body schema, we can look at individuals who have suffered damage (lesions) in specific brain areas to learn what the functions of those areas are. One study we can look at that explored this type of damage is one led by German researchers Bernhard Baier and Hans-Otto

⁵ See (Tsakiris, Hesse, Boy, Haggard, & GR, 2007)

Karnath in 2008⁶. As part of their study, they examined 79 stroke patients whose strokes resulted in left-sided body weakness or paralysis. Their goal was to investigate how stroke-induced brain damage resulted in changes of awareness of body ownership and body movement. Using brain scanning equipment they were able to investigate which brain regions resulted in this type of damage.

One condition they investigated was called Anosognosia for hemiplegia (AHP). AHP is a condition where a patient can suffer from paralysis but be completely unaware of the affliction. They might have a paralyzed arm or leg yet not recognize this at all. Another condition they investigated was called Disturbed sensation of limb ownership (DSO). With DSO a patient can feel like a paralyzed limb does not belong to their body. This is a symptom known as asomatognosia. Patients with asomatognosia might even feel like their paralyzed limb belongs to someone else such as a doctor or relative that is in the room with them.

Of the patients that were unaware of their paralysis, 92% of them experienced a disturbed sense of limb ownership. By comparing their brains with the brains of healthy individuals they were able to pinpoint the source of these limb delusions. They discovered it was damage to the right posterior insula that was the culprit. This study was in fact a breakthrough in correlating the insula to perception and neural representation of body ownership.

Interoception

So far, we have explored the notion of body schema, which is about being aware of where our body parts are in relation to each other, and the notion of body ownership, which is about having the perception that our body actually belongs to us. Both of these perceptions are based on specific brain regions that are dedicated to this type of neural processing. The third neural correlate of *rupa* or “being a body” is a type of perception called interoception. This type of perception is about the sensations that emerge from our bodies which are then perceived by the brain. Examples of interoception are hunger, fullness, thirst, need to eliminate waste, heart rate, breathing rate, body temperature, body pains and many other such perceptions. Generally speaking, interoceptive perceptions are designed to motivate your behavior

⁶ See (Baier & Karnath, 2008)

in a way that keeps your biological state within healthy operating parameters. As we saw earlier, this is known as homeostasis.

Homeostasis-driven interoception is largely managed by a brain region called the insula which is the same region we encountered when looking at how the brain creates a sense of body ownership. The insula is a key brain component that creates a sense of being a body and determines if that body is functioning in a way that is within homeostatic parameters. The insula and posterior parietal cortex are the brain regions that are dedicated to creating the lived experience of being a body.

4 - FEELING TONES (VEDANA)

If we take a bite out of an apple and experience pleasure or displeasure from it, we are experiencing something that Buddhism calls *vedana*. This chapter explores both the Buddhist and Scientific understanding of *vedana*.

Translating and Defining Vedana

Earlier we looked at the concept of Asavas which we saw could be loosely translated as “intoxicating survival drives” or something similar to that. The “intoxicating” analogy points to the idea that they cloud our minds and influence our behavior. One of these mental intoxicants is a drive to experience pleasure. This pleasure exists as a reward in order to influence us to engage in behaviors that evolution has determined are conducive to survival and procreation.

The capacity to experience both pleasant and unpleasant sensations is called *vedana* in Buddhism. In the *Mahāvedalla Sutta* (“The Great Elaboration Discourse” - MN 43), the Buddha defines *vedana* this way:

“They speak of this thing called ‘feeling’. How is feeling defined?”

“It’s called feeling because it feels. And what does it feel? It feels pleasure, pain, and neutral. It’s called feeling because it feels.”

Vedana is shown to have three states: pleasant, unpleasant and neutral. In another place in the discourse, he links *vedana* with *viññana* (differentiating awareness):

"They speak of 'differentiating awareness'. How is differentiating awareness defined?"

"It's called differentiating awareness because it is aware. And what is aware of? It is aware of 'pleasure' and 'pain' and 'neutral'. It's called differentiating awareness because it is aware."

In the *Chachakka Sutta* ("Six By Six Discourse" - MN 148) the Buddha shows how *vedana* arises. Taking eyesight as a source of good, bad or neutral feeling the Buddha explains:

Eye differentiating awareness arises dependent on the eye and sights.

Eye differentiating awareness arises dependent on the eye and sights. The meeting of the three is contact.

Eye consciousness arises dependent on the eye and sights. The meeting of the three is contact. Contact is a requirement for feeling [vedana].

The Buddha elaborates this chain of causation of all of the six sense types. The implication of this is that pleasure and pain never exist in a vacuum. They require sensory perception as a precondition. Pleasure and pain as rewards and punishments exist in the context of differentiating awareness of external and internal objects and phenomena. For example, if you taste something that is exceedingly bitter, your brain will likely generate an aversive feeling as a result. We can hear a beautiful song which will likely feel pleasant.

The Neurological Correlates of Pleasure and Liking

As we move around and interact with the world and its objects, our brain sends rewards and punishments into consciousness to act as guardrails to keep us focused on approaching objects and scenarios which are conducive to survival and avoiding objects and scenarios which are not conducive to survival. Scientists call this type of experience "hedonic feeling tones". "Hedonic" just means pleasant or unpleasant sensations. It is important to note that in popular usage, "feelings" can mean emotions like sadness or

happiness, but this is not how the term is used here. We are talking about the raw experience of sensory information being either pleasant or unpleasant.

An organism's capacity to experience hedonic feeling tones is very old from an evolutionary perspective. Since feeling tones are signals to approach or avoid, this is a mechanism that was useful to even the simplest multicellular organisms. Even something as simple as a worm crawling through dirt benefits from the motivation of liking something it encounters. This "Liking" is a real-time experiential phenomenon. It is an experience revolving around what is happening in the present moment experience of the organism. It is worth pointing out here that "liking" is different than "wanting" from a scientific perspective⁷. While "liking" is real-time and present moment focused, "wanting" is about what an organism should do in the future based on what it has learned. When we are talking about vedana, we are only looking at the experience of "liking". "Wanting" will be discussed in detail when we explore the concepts of desire (chanda) and craving (tanha).

The experiences of "liking" and "wanting" are implemented in animals using chemicals known as neurotransmitters and neuromodulators. In general audience books and articles, both neuromodulators and neurotransmitters are often referred to generally as "neurotransmitters", and we will keep that informal convention here for simplicity. Neurotransmitters are tiny chemical messengers that neurons use to communicate with each other. When one neuron wants to send a signal, it releases neurotransmitters into the small gap between cells, called a synapse. These chemicals then attach to special receptors on the next neuron, which can either "excite" it (making it more likely to fire its own signal) or "inhibit" it (making it less likely to fire). Different neurotransmitters, like dopamine, serotonin, and glutamate, are involved in many functions, including mood, movement, learning, and sleep. In simple terms, neurotransmitters help coordinate everything your brain and body do by carrying messages from one nerve cell to the next.

The "liking" chemicals in the central nervous systems of animals and their neuronal targets are evolutionarily ancient and date back hundreds of millions of years to the ancestor of all currently living vertebrates. To help us understand the basic mechanisms involved in these ancient processes, it can help to see how they work in simple animals that are similar to our common ancestor⁸. A good candidate for this analysis is a small free-moving

⁷ See (Berridge, 2009)

⁸ See (De Robertis, 2008)

nematode worm called *Caenorhabditis elegans*⁹. It is a relatively simple organism and its central nervous system has been extensively mapped out by scientists, so it is a great subject to study to see the functioning of the simple predecessors of the more modern liking mechanisms found in our brains.

C. elegans and similar types of organisms generally have two main operating modes: “Roaming” and “Dwelling”. Here are the details of these two modes:

- **Roaming** – The worm moves about until it finds food or encounters danger.
- **Dwelling** – The worm has discovered food, so it needs to cease its roaming and begin consummatory (eating) actions.

When the worm is in roaming mode and chemically detects food, it reacts neurologically in various ways. One of the actions is that the worm’s central nervous system releases a neurotransmitter called dopamine. This chemical tells the worm to “slow down”. Another neurological action that happens is that a neurotransmitter called serotonin is released and this tells the worm, “Start your eating behavior”. Then, depending on its hunger level, it might release a neurotransmitter called NLP-24 which is a type of chemical called an opioid neuropeptide. This opioid neurotransmitter triggers the worm to vigorously feed. Another neurotransmitter tied to hunger level is one called Anandamide. It is a type of neurotransmitter called an endocannabinoid. This chemical motivates the worm to be picky and only select high quality food items¹⁰.

In the context of talking about feeling tones, one of the most salient things to note about the worm’s use of neurotransmitters is that the opioid neuropeptide is evolutionarily related to the opioid neurotransmitters found in humans. In more evolutionarily complex animals such as humans, opioid neurotransmitters are one of the key neurological players that create the experience of “liking” or “pleasure”. Seeing this chemical lineage illuminates the concept that liking and pleasure are signals to motivate consumption. They are very much “real-time” chemically derived experiences that influence present moment consumption or other pleasant actions, and their origins are evolutionarily ancient and are a fundamental part of how organisms operate.

Additionally, it is notable that *C. elegans* makes use of an endocannabinoid neurotransmitter in its neurological control of feeding behavior. In

⁹ See (Sawin, Ranganathan, & Horvitz, 2000) and (Flavell, 2013)

¹⁰ See (Levichev, 2023)

humans, endocannabinoids can magnify the extent to which sensory input is pleasurable. It increases the subjective liking that someone can experience and motivates us to seek out high-quality food. It is interesting to see an evolutionarily conserved example of “the munchies” in action and it shows again how modern neurological functionality can have ancient origins.

Another thing that is helpful to notice at this point is that the neurotransmitter dopamine is not directly correlated to the experience of real-time consummatory “liking”, but rather it is correlated to behavior that helps reach this pleasure. Dopamine triggered the worm to stop and approach but it was the opioid neurotransmitter that mediated the actual “liking” of the food, signaling “this is good, keep doing it.” This distinction between the drive to get something and the pleasure of having it is crucial. This is a key point that we will explore later when we dive into the intricacies of “wanting” and “desire”.

Pleasure Centers in the Human Brain

The basic blueprint of “liking” that existed in our ancient ancestors and still exists in relatively simple species such as *C. elegans* has been elaborated on substantially in more complex species. In the simpler species like *C. elegans*, “liking” seems to be rather mechanical without much, if any, conscious awareness, but in more complex animals the existence of consciousness provides an “audience” for a more sentient experience. As we touched on earlier in the section on consciousness, it seems likely that any animals with a brainstem, thalamus and hypothalamus would be a “sentient being” and would be able to experience the subjective experience of “liking” and pleasure.

We saw that in simple animals like *C. elegans*, an opioid neurotransmitter was used to signal that creature’s version of “liking”. The same is true in our brains. Opioid neurotransmitters are a key participant in the subjective and real-time experience of “liking” something that we are sensing. The key region that contains the opioid neurotransmitter receptors for this is something called the ventral pallidum which is an evolutionary ancient part of the brain. This region is arguably the central station for the liking experience due to the fact that if it is damaged or knocked offline the ability to experience pleasure is completely lost¹¹. The ventral pallidum is one of

¹¹ See (Cromwell & Berridge, 1993)

the most ancient and fundamental parts of animal brains. All vertebrate animals have one or something very similar to it.

The nucleus accumbens is not the only brain region that processes pleasure. The brain has various “hedonic hotspots” that participate in the experience of “liking”. Some of these regions amplify pleasure and some like the cerebral regions in evolutionarily modern “Neocortex Complex” of the brain add high-level cognitive context to what we are experiencing. One of these hotspots is the nucleus accumbens. Like the primitive circuitry that is found in *C. elegans*, the nucleus accumbens makes use of endocannabinoid and opioid neurotransmitters to amplify “liking” sensations as real-time motivation for consumption.

To save you from having to remember too many brain regions, for the rest of the book we will call the ventral pallidum the “pleasure center” and the hedonic hotspots collectively the “pleasure centers”. Similarly, we will refer to opioids and endocannabinoids as “pleasure chemicals”.

The Neurological Correlates of Disliking

Liking and pleasure are only one side of the vedana coin. We will now look at the neurological correlates of disliking. Aversive sensations are an imperative part of an organism’s survival toolkit and, like pleasure, existed very early in evolutionary history. The disliking of aversive sensations is how an organism is alerted to a situation of the type, “this is bad for survival, do something!” Unsurprisingly, the core brain regions of hedonic hotspots for liking, the ventral pallidum and the nucleus accumbens, are also the locations of “cold spots” for disliking. And just like their usage of certain opioid neurotransmitters for pleasure, they use other opioid neurotransmitters to signal unpleasant sensations. And similarly, just as *C. elegans* had ancient mechanisms for opioid-based neural activity that is analogous to “liking”, it also has opioid-based neural activity that is analogous to disliking. This illustrates how aversive feelings are an ancient and core part of the survival strategy for all vertebrates, not just humans.

For the rest of the book, we will call the ventral pallidum and the nucleus accumbens the “aversion centers” and the related opioids “aversion chemicals”.

Liking and Disliking Help an Organism Survive

The most important take away here is that pleasure is a way for the brain to determine how much a particular interaction helps us survive. “Liking” (pleasant sensations) is a real-time incentive to engage in survival activities. Conversely, “disliking” (unpleasant and aversive sensations) is a real-time signal that something that is happening in real-time is detrimental to survival.

5 - PERCEPTION (*SAMJNA*)

If you can see the shape of an apple as “roundish”, the color of an apple as “red” and recognize the totality of what you are experiencing is an “apple” due to previous encounters and learning, you are having the real-time experience that is labeled as *samjna* in Buddhism.

Translating and Defining *Samjna*

The most direct translation of the *samjna* aggregate is “perception”. In the *Sattatthana Sutta* (“Seven Bases Discourse” - SN 22.57) the Buddha gives a basic definition of this term:

“And what is perception? These six bodies of perception — perception of form, perception of sound, perception of smell, perception of taste, perception of tactile sensation, perception of ideas: this is called perception.”

In another sutta called *Khajjanīya Sutta* (“The Bitable Discourse” - SN 22.79) he defines it as:

“And why, bhikkhus, do you call it perception? ‘It perceives,’ bhikkhus, therefore it is called perception. And what does it perceive? It perceives blue, it perceives yellow, it perceives red, it perceives white. ‘It perceives,’ bhikkhus, therefore it is called perception.”

This is not too terribly different than his definition of differentiating awareness (*viññana*) where he lists attributes detected by the taste sense such as bitterness, sweetness, etc. Since both definitions list sense perceptions as part of their definition, it is reasonable to ask what the actual difference is

between perception and differentiating awareness. At some level it is hard to distinguish them fully. In fact, in the *Mahāvedalla Sutta* (“The Great Elaboration Discourse” - MN 43), the Buddha is explicit about this:

“Feeling, perception, and differentiating awareness—are these things mixed or separate? And can we completely disentangle them so as to describe the difference between them?”

“Feeling, perception, and differentiating awareness—these things are mixed, not separate. And you can never completely disentangle them so as to describe the difference between them. For you perceive what you feel, and you cognize what you perceive. That’s why these things are mixed, not separate. And you can never completely disentangle them so as to describe the difference between them.”

Yet, despite this explicit intermixing, he does distinguish them as separate components in the five-aggregate classification, so he clearly defined them separately to some extent. *Samjna* is best understood as the senses receiving sensory information about objects and the recognition of the attributes that make up an “object” and also allow us to identify it. By contrast, differentiating awareness is our capacity to be aware that these sensory objects are being perceived.

To look at *samjna* a little more subtly, we can look at an 11th Century work called the *Abhidhammattha Sangaha*. This work shows that the concept of *samjna* involves not just perceiving object attributes but also remembering them and recognizing them later. Here is a passage translated by Bhikhu Bodhi in *A Comprehensive Manual of Abhidhamma*:

The characteristic of perception is the perceiving of the qualities of the object. Its function is to make a sign as a condition for perceiving again that ‘this is the same,’ or its function is recognizing what has been previously perceived.

When the mind has recognized an object based on its characteristics and we are able to recognize it, we are then able to name it and include it in conceptualization. Supporting this idea, we have this quote from a 5th

Century Yogacara philosopher and sage Vasubandhu in his work *Abhidharma-kośa-bhāṣya*¹²:

Perception is the cause of language. One creates a name for a thing only after having grasped the sign of the thing by means of Perception; and language, speech, has naming as its cause.

Another Yogacara source that establishes the connection between perception and naming is the 7th Century Chinese work *Cheng Weishi Lun* (*Discourse on the Perfection of Consciousness-only*). Here is an excerpt from this work¹³:

"The nature of saṃjñā is to grasp the characteristics of the object. Its function is to establish the boundaries of names and words. That is to say, it creates the mental conditioning that allows one to say 'This is such-and-such a thing' by distinguishing the specific marks of the object (blue, yellow, etc.) from what it is not."

How the Brain Perceives and Names Objects

A comprehensive summary of how the brain processes various sensory information when perceiving objects would require me to list dozens of brain regions and explain how they cooperate in the merging of the various sensory and memory signals in a representation of an identified named object. Mercifully, in understanding how the brain represents and names objects in a five-aggregate context, we don't need to know the details and can stick to a high-level overview.

During the *viññana* (differentiating awareness) cognitive process, a brain region known as the thalamus coordinates the cooperative functioning of many brain regions to produce a final mental representation of an object in a region called the perirhinal cortex. At that point in sensory processing, we have not named the object or seen how it fits into a larger contextual temporal picture. In scientific terms we can say it is pre-semantic and pre-episodic. In other words, we have not yet thought about the object conceptually or considered how the object fits into the timeline of our lives.

¹² Excerpted from (Vasubandhu, 1988)

¹³ Excerpted from (Xuanzang, 1999)

To help us understand how this pre-conceptual object representation process works, let's consider a muffin that we are holding in our hands. Many sensory elements will first flow into our brains from our senses. These senses will first be highly disorganized and not at all sorted into discrete signals that could be associated with a single object. For example, if we were at a bakery our eyes would also be taking in sights of the floor, the counter in front of us, other baked items in the counter, our hand holding a muffin, a bakery worker along with dozens of other items. You would be smelling various objects in the room and hearing the sounds produced by some of them. You would feel the warmth of a freshly baked muffin and feel the texture of the wrapper. You would feel a tactile sense of the weight of the muffin.

The first thing the brain needs to do is simultaneously sort through all of these sensory elements. The visual, olfactory, tactile, audio and perceptual processing areas in the brain would first work towards breaking their respective energy streams of sensory input into discrete units. For example, the visual processing systems first break the visual data into edges, surfaces, size, shading, color, brightness and so forth. Then it would work at sorting through these elements to figure out which ones belong together. For example, it would sort some of the elements together into what will eventually be identified as muffin and some of the elements would be sorted together into what will eventually be identified as a bakery employee.

After individual sensory streams have sorted their sensory information into discrete object representations, these sensory object representations will be combined into a cohesive multi-modal representation in the perirhinal cortex. For example, this is where the separate sensory qualities of sight, smells, weight and feel will be combined into the yet-unidentified muffin object representation. The brain would simultaneously be doing this with other object representations as well. For example, if the bakery employee was talking, the sound of their voice would be combined with their visual representation to create a cohesive object representation.

The next step in this process is called affordance recognition. It is also called action-oriented object recognition. This is a perceptual feature found in many animals. For example, a lion does not have explicit names for things, but it knows a gazelle when it sees one and intuitively knows what actions are applicable to it. The same thing could be said about a lion recognizing another lion. The actions useful and appropriate when interacting with another lion are different than the actions that are useful and appropriate when interacting with a gazelle. A lion knows the difference between a gazelle and a lion even if it has no need to name them with language.

The final step in the perceptual process we are looking at is the ability to name an object. Humans are not the only animals that have vocalizations that can be associated with different categories of objects. For example, vervet monkeys have different alarm calls for different types of predators¹⁴. For example, there is a distinct call for “eagle” that will cause them to look up in the sky and run for cover. They also have a distinct call for “snake” that will cause them to stand up and look in the grass. Up until this point the neurological function is very similar in both humans and the vervet monkey species. They both have a thalamus project managing the perception process and the final multi-modal mental representation of objects exists in their perirhinal cortex.

Where humans seem to be unique is the ability to give arbitrary, socially agreed upon names to virtually anything that is discovered and then combine those names into an unlimited variety of expressions.

Perception, Semantic Processing and Prediction

As we go through our lives, we encounter an endless stream of objects and scenarios that our brain needs to perceive and process. We do this with a mind full of prior knowledge about objects, the names of objects and complex relationships and associations. We can call this knowledge about the world semantic memory. Part of this process includes a non-language “action-oriented object recognition” of objects that allow very quick reactions even before we really know what we are processing. The phases of this process are fast recognition, prediction evaluation and resolution. This entire process can take under a second. For this section, we will look at the first two steps.

The first step is fast recognition. This is the phase where the thalamus coordinates the perception areas of the brain to quickly analyze information coming into our senses and assemble a multi-modal object representation in the perirhinal cortex. Part of this process includes a non-language “action-oriented object recognition” that allow very quick reactions even before we really know what we are processing. As part of the non-language tagging of the object representation, the attributes of the object are loaded into memory. For example, if we are walking through an orchard and we focus on an apple hanging off a tree, the attributes of the apple (fruit, sweet, edible) are loaded into memory even before we have formally “named” the

¹⁴ See (Deshpande, van de Waal, & Zuberbühler, 2023)

object with language¹⁵. The brain also uses this step in the process to load in the background context of the scene we are currently perceiving¹⁶. For example, it might notice and tag “orchard” and “tree”.

The next step in the process is prediction evaluation. Earlier in this book, we talked about how the brain is a prediction and inference machine and this is one of the major examples. The brain uses its semantic and episodic memory to constantly predict what it expects at any given moment. One of the semantic bits of information that most of us have in our brains is that apple trees don’t normally have fruit in them in the late winter. If our stroll through the orchard was during the late winter, the existence of the apple might very well set off some alarm bells in our brains. This is because the brain’s prediction that “there are no apples on trees in late winter” is conflicting with the situation that is being perceived. Scientists call this a “prediction error”. When the brain encounters prediction errors it usually leaps into action in some manner, and in this case the brain decides to set off an alarm to pay more attention and evaluate the situation. The parts of the brain that are scanning our fast perceptions are collectively called the “salience network”¹⁷. The salience network takes a fast and “low resolution” look at what the brain is perceiving to determine if it needs to signal potential prediction errors. It is looking for behaviorally relevant, surprising and salient information that might be of interest. Since its analysis is not detailed, it needs to recruit some friends to do a deeper dive and more thorough analysis when a prediction error is detected.

The friends that it recruits are some of the components of two brain networks. The first one is a knowledge and self-related network called the default mode network and the second one is a reasoning network called the central executive network¹⁸. The default mode network has many tasks but one of its main responsibilities is to analyze objects and scenarios based on prior semantic knowledge of the world. The central executive network is in charge of logical reasoning and task planning. When the processing of the sensory scenario we are encountering is handed off to these networks, that is when sophisticated conceptual cognition kicks in.

¹⁵ See (Patterson, Nestor, & Lambon Ralph, 2007)

¹⁶ See (Epstein & Kanwisher, 1998)

¹⁷ See (Botvinick, Cohen, & Carter, 2008)

¹⁸ It is also called the frontal parietal network and the multiple-demand network, but we will use “central executive network” because the name is more self-explanatory as to what its function is.

In our confusing orchard scenario with its out of season apple, the role of the default mode network is twofold. The first cognitive task it is responsible for is knowing the basic rules of the universe. The default mode network is the library that understands concepts such as apple, orchard, season and appropriate ripening times. It doesn't just understand these concepts individually, but very importantly it understands how they relate to each other. The default mode network also is able to cognize our current situation and conceive as it is as a whole¹⁹. The combination of our current situation, an understanding of how things ought to be and how those might be in opposition is then used by the central executive network to logically come to a theory of why that apple is there. Perhaps it isn't as perfectly ripe as it looks? Maybe it is an ornament? Maybe it has been unseasonably warm and normal patterns of ripening are not applicable?

¹⁹ See (Pearson, Heilbronner, Barack, Hayden, & Platt, 2011)

6 - DECISION MAKING (SAMSKARA)

To continue the story of our stroll through the confusing apple orchard, once the salience network, the default mode network and the executive control network have all weighed in with a “vote” that the apple is indeed surprising, it might be time to make a decision. Do we go and investigate it? Do we not care enough to interrupt our walk? Even if we do care about it, do we have other priorities and obligations?

The process of identifying these decision options, weighing them and then deciding among them is the process represented by the *samskara* aggregate. It takes all the other aggregates as well as various other cognitive factors as inputs and uses them to come to a decision. It is the way the brain decides how to interact within and with the world around it.

Translating and Defining Samskara

Along with *asavas*, *samskara* might be the Buddhist term with the widest variety of translations people have come up with. Technically speaking, “formations” might be the most accurate translation from a literal perspective, and you’ll find it in many Heart Sutra translations, but in the context of the five aggregates it’s not at all descriptive or helpful. “Fabrications” is another similarly unhelpful translation in a five-aggregate context. Others have translated it as “volitional formations” and that gets closer to the mark but is not a great translation because much of the functioning of the *samskara* aggregate is unconscious and not volitional. Some translators use “choices” which is the best one so far but since *samskara* in a five aggregate context is an activity and not a result, so “choosing” would be more accurate. I have opted for “decision making” over “choosing” because I feel that it flows better in sentences. Why do translators use terms like “choices”. You can

see the usage here in an excerpt from the *Sattatṭhāna Sutta* (“Seven Cases Discourse” - SN 22.57):

And what is saṃskāra? There are these six classes of intention: intention regarding sights, intention regarding sounds, intention regarding smells, intention regarding tastes, intention regarding touches and intention regarding ideas. These are called saṃskāras.

It is the mental processing that leads towards what we intend to do. What goes into these choices? This is detailed in the *Abhidharmasamuccaya* written by the Yogacara sage Asaṅga :

“Although all mental factors apart from feeling and perception, together with formations not associated with mind, belong to the saṃskāra aggregate, intention is preeminent and acts as the leader of all the formations. For this reason, it is singled out.”

It is all the mental factors that go into what we intend to do before we actually do it and much of it is subconscious. It is the process of deciding what to do before we do it.

The Default Mode Brain Network

We mentioned the default mode network previously in passing, but since it plays such an important role in decision making, we are going to make a formal introduction to it here. The default mode network is one of the main participants in the deliberation process of decision making. Our brains have various named regions such as the hippocampus, amygdala, corpus callosum and the cerebellum. While certain brain regions have different “jobs”, most of the tasks that our brains do involve coordination of multiple brain regions. These coordinated brain regions are called “brain networks”. There are brain networks for attention, sensory processing, executive functioning, learning and so forth. An understanding of the “Science of Zen” largely involves understanding how a few key brain networks operate and interact with each other.

While in this chapter we examine the ways in which the default mode network actively engages in decision tasks, it got its name when scientists noticed the brain was quite active at rest between tasks. The first scientific

paper that described the default mode network was written by a researcher named Marcus Raichle. He and his team were using a cutting-edge technology called PET in the late 1990s to peer inside the working brains of humans. In their paper entitled “A default mode of brain function”, they detail how they observed a specific, consistent network of brain areas that showed a reliable decrease in activity whenever subjects switched from a passive resting state to an attention-demanding, external task. This finding led them to conclude that the brain was not simply idle during “rest,” but was instead highly engaged in daydreaming. Since this was the state of the brain when it was not doing something active and externally focused, they named it the “default mode network”.

As it turns out, “default mode network” is perhaps not the best name for these cooperating brain regions because these same areas will often light up when doing some specific tasks such as thinking about oneself, thinking about others, making decisions and thinking abstractly. It is also highly active when we are ruminating and worrying. It doesn’t just activate while in relaxed rest. It would probably have been better to name it the “self-relevance network” since its most common task is to cognize about the self in a time-traveling and abstract manner. It engages in this self-focused mental activity both at rest and during self-focused active tasks. Still, since “default mode network” is what you will find in both scientific and popular works, we will reluctantly stick with that.

Since Zen Buddhism is all about exploring the nature of self and seeing through it, it might not be too surprising why the brain network that cognizes about “self” might be of primary interest to us. This book is largely focused on how the default mode network functions and what the implications of this functioning are. It explores how other brain networks interact with the default mode network in ways that make Zen practice and liberation possible.

Subjective Value

To understand how the brain makes decisions we must first understand how it values the objects, scenarios and phenomena that it is able to sense or conceive of. It needs a common currency that it can use to compare things that might be dissimilar from each other to various degrees. For example, my brain is able to confidently determine that it likes a band named the Grateful Dead more than it likes a dessert called a Banana Split. The common currency of value allows me to compare such abstract and dissimilar things. While they are very different from each other, they both have some

degree of subjective value to me, and I can compare that value. For an example that might be more appropriate to the discussion of decision making, I can compare eating a piece of cake to the idea of staying fit and healthy. Both of these have some degree of subjective value in my brain and in some situations, I might need to compare these subjective values as part of a decision-making process. This common currency of value is what makes sophisticated decision making possible.

The brain's computation of subjective value in the decision-making process is based on past interactions with objects and scenarios. We essentially have two databases in our brain that map objects and scenarios with an estimated value of how much pleasure they may bring us in the future when we interact with them. The first database is an ancient brain region called the ventral striatum. It does not have very sophisticated or nuanced opinions about objects and scenarios but caches brute force associations with learned values. When we go through life and experience interactions with objects and scenarios and experience good or bad feeling tones associated with them, the brain's reward system remembers and caches these associations in a Pavlovian manner. The more often we get similar feeling tone results from interactions the stronger the reinforcement becomes and the stronger the ventral striatum's opinion becomes.

The second database is a brain region called the orbitofrontal cortex. Unlike the ventral striatum's unsophisticated opinions, the orbitofrontal cortex is much more sophisticated and takes into account current context when calculating subjective value. For example, the ventral striatum might have a general opinion that "cookies are great!" but the orbitofrontal cortex can have a more nuanced opinion like, "cookies are not very appealing when I am full".

Steps of the Brain's Decision-Making Process

The following are the steps the brain takes in making a decision²⁰. From a ready state, the brain is first alerted to the need for a decision, then options are identified, then the decision is made and then finally there is the implementation of the action decided upon. When we are looking at *samskara*, our examination stops right before the implementation or enactment of the decision. The steps of the decision-making process are:

²⁰ See (Rangel, 2008) for a good overview of value-based decision making

- **Step 0 - Prior to the Trigger** – We might be engaged in a task or letting our attention get carried away by mind wandering.
- **Step 1 - The Decision Trigger** – Something interrupts our task or mind wandering and we become aware that a decision needs to be made.
- **Step 2 - Identification of Options** – The options available to us need to be brought to mind so we know what to deliberate about.
- **Step 3 - Habit Check** – If the decision is one that we make frequently under similar circumstances, we might just jump straight to an action.
- **Step 4 - Decision Formation** – Various brain regions and networks cooperate and compete to evaluate options and make a selection.
- **Step 5 - Option Selection** – An option that has been determined to have the most “value” is selected from the competing candidates.
- **Step 6 - Executive Check** – This is the last chance that the central executive network has to check and validate the decision before it is turned into action.
- **Step 7 - Action** – A decision has been made so now it needs to be executed.

With this high-level map of the decision-making process in mind, let’s now look at each step in more detail.

Step 0 - Prior to the Decision Trigger

At any given waking moment, the brain is generally in one of two modes of operation²¹. These two modes of operation are “default mode” and “task mode”. As you may have guessed, the default mode is largely controlled by the default mode network. When the brain is in default mode, the default mode network is typically involved in mind wandering. The brain uses “down time” to think about the past and wonder about the future. It may also use this down time for creative thinking. If there are pressing concerns, it may also make use of this time for worry and rumination.

When we stroll through an apple orchard, we are not doing a particular task that requires a significant amount of attentional focus or problem solving. Attentional focus and problem solving are metabolically expensive. Their activity costs a lot of the brain’s available oxygen and brain sugar, and this is a finite resource. Since those are not being used for tasks as we stroll through the orchard, our brain decides to use those resources to turn on the

²¹ For mind wandering see (Smallwood & Schooler, 2015)

full default mode network so that it can engage in its time-traveling mental mind wandering with the hope that it will use this downtime to creatively solve some pending issues. In our stroll we are relaxed so without the need to ruminate or worry, we spend the time pleasantly remembering a meeting we had with a friend yesterday. We didn't explicitly decide to revisit that memory, it just kind of happened.

Step 1 - The Decision Trigger

All of a sudden, we see the out-of-season apple and this mind wandering is immediately shut off and the task, "focus on this apple" is switched on²². Behind the scenes, the salience network was quietly paying attention to many things at once. One of the things it was paying attention to was what we were perceiving through our vision. It has a basic idea of what a "normal" apple orchard looks like at this time of year and when it detected an anomaly, it quickly asked the central executive network to work with parts of the default mode network to verify that this is a weird scenario that is worthy of attention. These networks concurred that the apple was indeed strange, so the salience network stopped our mind-wandering and switched us into task mode. This is where we move from the perception aggregate to the decision-making aggregate.

Mind wandering will be interrupted if the brain detects something important that must be attended to in the present moment. This "something important" might be something internal that is perceived through one of the senses or it might be something that is felt inside the body. It might also be a sudden remembrance of something we intended to do.

As mentioned earlier, the brain network that keeps an eye out for important situations is called the salience network. It is constantly scanning our minds, bodies and the outside world for salient situations that require us to engage in a task to deal with the newly identified issue. Sometimes we will already be doing a task, and a new one preempts it but usually we will be in default mode, and the salience network will switch us away from that state into task state.

A task is something we physically or mentally do and whenever there is an action, there needs to be a decision of whether to actually do the actions or which option to choose if more than one is available. This is what the purpose of decision-making is: to select an action option during a task.

²² For salience switching see (Menon & Uddin, 2010)

Step 2 – Identification of Options

When the salience network has detected that something is indeed salient, it switches us into task mode and hands off control of the situation to the central executive network. One of the first things the central executive network needs to do is determine what the task actually is and what action options are available to it in response to the task. Sometimes the options are “do this task or don’t do it”. Other times there are multiple options. An example of a “do it or don’t do it” type of task is when we hear water dripping in the bathroom sink while we are in bed. Our two options are to just stay in bed and deal with it or get up and turn it off. Our out-of-season apple in the orchard scenario is another example. At least initially we have the choice of moving closer to it to investigate this situation or just continuing on with our walk.

In situations when there might be more than one option, the options we come up with are heavily influenced by our current context, what knowledge we have and our self-identity. Current context can be homeostatic states like hunger²³. For example, if we are holding a donut and accidentally drop it on the floor, the default options that the central executive network comes up with might be 1) Leave it there 2) throw it away. However, if you are extremely hungry, you might sheepishly notice there is a third option that involves eating it.

The general knowledge we have about the universe also influences what options we might come up with when faced with a salient situation²⁴. For example, if my car broke down on the side of the freeway my imagined options would likely be to leave it there or get it towed. However, if I am a skilled mechanic, a third option of trying to fix it myself by the side of the freeway might present itself as well.

Self-identity is another variable that influences what options our central executive network identifies when faced with a task²⁵. Dictionary definitions of self-identity are usually something like, “An understanding of one’s skills, values, preferences, roles and qualities as an individual, especially in a social context.” It is a story of who we are, what we are like and what we are capable of doing. For example, if I have a self-belief that I am not the type of person who takes what does not belong to me and I see someone drop a twenty-dollar bill, I am more likely to conceive of the option of letting

²³ See (Symmonds, Emmanuel, Drew, Batterham, & Dolan, 2010)

²⁴ See (Raab & Johnson, 2010)

²⁵ See (Oyserman & Destin, 2010)

them know they dropped it. If I have the belief, “life is hard and I should take what I can, when I can”, then I would be less likely to consider the option of letting them know they dropped it.

Step 3 - Habit Check

When we are faced with a decision or problem that we commonly encounter and can successfully resolve in a predictable manner, the brain will do its best to make it a habit. It is time consuming and metabolically expensive to deliberate in decision making, so whenever the brain can take a shortcut, it will do so²⁶. This makes sense because if you have to deeply deliberate at every little step in life, you will never get anything done. For example, imagine if you had to deeply analyze and figure out how to get out of bed, use a toilet, decide when to eat, figure out how to cook, figure how to put on clothes, relearn how cars work and plan in detail how to get to work. If our brains required significant amounts of attention and deliberative processing for each encounter we faced, life would become impossible. In general, the brain wants to find areas where decision making can be predictable, effortless and fast.

In order to implement this, the brain makes use of ancient neural circuitry in the brain called the dorsolateral striatum (also known as the posterior putamen), and it is crucially involved in forming, executing, and maintaining habits and routines, linking sensory cues to actions for persistent, often automatic, behaviors, and organizing actions in sequences over time²⁷. When the dorsolateral striatum detects a sensory cue, it very quickly can ascertain if there is a habitual response that matches the scenario. The salience network and the central executive network will then take a look at the dorsolateral striatum’s habit proposal and weigh in on how confident they are that the habit matches the current situation²⁸. The default mode network can also weigh in at this stage²⁹. Self-identity, social consequences and moral rules can play a role in deciding if a habit should be allowed to progress and these types of cognition are the domain of the default mode network. If these networks have high confidence that the habit is a good

²⁶ See (Daw, Niv, & Dayan, Uncertainty-based competition between prefrontal and dorsolateral striatal systems for behavioral control, 2005) and (Kool & Botvinick, 2018)

²⁷ See (Yin & Knowlton, 2006)

²⁸ See (Lee, Shimojo, & O’Doherty, 2014)

²⁹ See (Smith, Fareri, & Dobryakova, 2025)

match for the current situation, the dorsolateral striatum's habit choice is allowed to progress. If confidence is low, then the brain kicks off what is called decision formation to engage in deliberation in order to select an appropriate selection from available options.

In our out-of-season apple in the orchard scenario, there wouldn't be any habits that are relevant to this situation. Seeing an out-of-season apple is a novel experience and that is why it caught our attention in the first place.

Step 4 - Decision Formation

The decision formation is the phase of the decision-making process where various parts of the brain both compete and cooperate with each other to work towards determining the "subjective value" of each of the decision options that have been identified. Some parts of this process are volitional and controlled by the central executive network but most of it happens unconsciously and happens without our direct knowledge. Sometimes the deliberation of the decision formation phase happens nearly instantaneously and sometimes it takes a considerable amount of time for the brain to select the option that it thinks has the most value. Remember that the brain's common currency of "subjective value" is an abstract representation of predicted future pleasure and that pleasure is an abstract measurement of the survival benefit of a particular real-time encounter.

Executive Control During Decision Formation

During the decision formation stage, the brain network largely coordinating the show is the central executive network. One of its primary duties during this process is keeping in mind the various options that are available during the process.³⁰ It also engages in analysis to determine what attributes of each option should be compared to each other³¹. For example, if someone is deciding between two purses to purchase, the central executive network may identify price, prestige, color and styles that it wants to compare.

In our out-of-season apple in the orchard scenario, the central executive network would maintain the "Should I figure out why that apple is there?" decision goal and the "keep walking" and "investigate the out-of-season apple" options in memory and maintain focus on them if it is able to.

³⁰ See (Gold & Shadlen, 2007) and (Brosnan, Sabaroedin, & Silk, 2020)

³¹ See (Hunt, Dolan, & Behrens, 2014)

Simulations of Future Options During Decision Formation

Once options have been identified and the decision formation process starts up the ventral striatum and orbitofrontal cortex start sharing their opinions of the subjective values of the different decision options. The orbitofrontal cortex also serves up relevant scenarios that might flow from the presented options and how they might feel if that option is selected in the current life context. You can think of the orbitofrontal cortex's output as a script of what might happen for a specific option.

Once an option's "script" is ready, it is time to actually run the simulations of the scenarios and see how it would feel. The brain network that takes the scripts (and the ventral striatum's valuations) and generates the simulations of the possible future scenarios is the default mode network. It actively visualizes the scenarios based on the scripts to determine how a particular option would feel. It does this for all the options so a comparison can be made. For example, let's say you are at a restaurant, and you need to pick between a salad, onion rings and french fries. Many factors play into which one you will choose but a big part of the process is that your brain will imagine what it would be like to eat each one and that imagined pleasure (or displeasure) will be added to the "score" for each option. This activity of future simulation is one of the primary roles of the default mode network³².

There are many studies that illustrate how the default mode network runs these simulations and one that we can look at was conducted by a team of researchers at Harvard University³³. Specifically, the researchers aimed to determine the role of the ventromedial prefrontal cortex in this process. The ventromedial prefrontal cortex is one of the key nodes in the default mode network. The researchers hypothesized that the ventromedial prefrontal cortex functions as a hub that integrates distributed knowledge about individual elements of an event, such as people and places, to help construct a cohesive simulation and generate an overall affective (pleasant or unpleasant) value for the imagined scenario.

To test this hypothesis, the researchers employed a functional MRI (fMRI) design involving 24 participants. In a preparatory session, participants listed people and places they knew personally and rated them for familiarity and pleasantness. During the fMRI scan, these participants were presented with novel pairings of these people and places and asked to

³² See (Sambuco N & PJ, 2022), (Gerlach, Spreng, Madore, & Schacter, 2014)

³³ See (Benoit, Szpunar, & Schacter, 2014)

vividly imagine interacting with the specified person in the specified location. This design allowed the researchers to manipulate the degree of prior knowledge available for the simulation (familiarity) and the resulting emotional value (pleasantness) while observing brain activity.

The results supported the authors' hypothesis, showing that ventromedial prefrontal cortex activation increased in correlation with the familiarity of the combined elements, suggesting it was actively integrating prior knowledge and simulating scenes. Furthermore, the study found that the ventromedial prefrontal cortex exhibited specific connectivity patterns with other brain regions that are part of the default mode network. Importantly, activity in the ventromedial prefrontal cortex tracked the anticipated pleasantness of the simulated episodes, even when controlling for the individual values of the elements, indicating that this region constructs the imagined pleasant or unpleasant quality of the future event.

In our out-of-season apple in the orchard scenario, our default mode network would run a simulation of what it is like to keep walking and ignore the apple and also a simulation of what it would be like to investigate the apple. It would feel the result of each simulation and use that to calculate subjective values for both.

The Central Executive Network can inject Logic into Option Simulations

We saw earlier how the central executive network keeps track of the overall decision-making process by keeping the decision and its options in mind as a solution is arrived at through deliberation. It is also involved with logical evaluation of decision factors that may influence the final subjective value by influencing what the default mode network simulated when considering options³⁴. For example, in the scenario where we are strolling through the apple orchard and see the unseasonable apple and have to decide whether to investigate it or not, our central executive network might realize that investigating the apple will make us late for a meeting we have scheduled. The central executive network would then influence the default mode network to include what "being late" would feel like when it simulates the "examine the apple" option. Since being late will likely feel bad, that variable would likely downgrade the overall subjective value of that simulation.

The ability of the central executive network to manually emphasize logically derived goals and rules can also be seen when it decides to prioritize

³⁴ See (Spreng, Stevens, Chamberlain, Gilmore, & Schacter, 2010)

long-term goals vs short-term concerns or pleasures³⁵. As an example of emphasizing long term goals, there is the classic scenario of deciding if we are going to eat that second piece of cake: we can decide to value long term weight maintenance over the short-term pleasure of eating the second piece. Lastly, another example of this idea is when the central executive network chooses to emphasize constraints like fairness and equality in the decision-making process³⁶.

Self-Identity and its Influence During Decision Formation

Another way that the default mode network influences decision is due to its centrality in processing the cognition that revolves around how we view ourselves, how we view other people and how we want other people to view us³⁷. These are enormously influential variables in how we simulate decision option scenarios. For example, imagine you are at the store buying something for an embarrassing medical problem and as you get close to the cash register, you notice that it is being manned by one of your friends. And it is not just a friend but someone who you have a romantic interest in. Not wanting to broadcast your embarrassing medical condition to them, you sneak back to the aisle you obtained the treatment product from and put it back on the shelf. The primary brain network that was driving that decision from a social and self-identity point of view was the default mode network.

Now imagine you are walking down the street, and you have just finished a soda. You look for somewhere to deposit the can in, but you do not see any recycling receptacles and only a trashcan. You are tempted to throw it away, but you refrain because part of your self-identity is that of someone who cares about the environment. Throwing the can away would cause too much cognitive dissonance and you decide to hold onto your empty can until you are able to recycle it. These types of moral rules are embedded into our self-identities. Some moral rules come through our own learned sense of right and wrong and others are cultural constructs that we learn from the societies we live in. For example, in one culture, spitting on the floor of a crowded public train would be no big deal. In another culture it would be horrifying for everyone around you, and you would be very unlikely to want to do it.

³⁵ See (Hare, Camerer, & Rangel, 2009)

³⁶ See (Knoch, Pascual-Leone, Meyer, Treyer, & Fehr, 2006) and (Stanley, Phelps, & Banaji, 2008)

³⁷ See (Molnar-Szakacs & Uddin, 2013)

In both of these examples, it is core nodes in the default mode network that do the cognitive evaluation of how you see yourself and how you want other people to see you. Usually, these two dynamics are intertwined. We often see ourselves how we wish people would see us or how we fear other people might see us.

In the out-of-season apple in the orchard scenario that we have been tracking, let's imagine that our primary hobby is interest in heirloom apples. If that were the case, our default mode network would put significantly more weight on the existence of the apple being personally meaningful to us and we would more likely choose the option to explore it. Our self-identity is like a filter that influences what is personally relevant and changes the subjective value of options if personal relevance is a factor.

All of the types of self-referential processing that are being discussed in the section are what we can call "dualistic conceptualizations". They are dualistic in the sense that they are about the relationship between ourselves and objects outside of ourselves. They are conceptual in the sense that they are complex associations that exist in a larger schema of self-related beliefs. This type of dualistic conceptualization is called *prapanca* in Buddhism and we will discuss it further in another chapter.

Step 5 - Option Selection

As the default mode network is running simulations of the future and the central executive network is making sure that the decision scope is well understood, that all relevant options are being considered and logical analysis is being taken into consideration in deliberation, a node in the default mode network called the ventromedial prefrontal cortex is keeping track of the subjective value "score" for each option that is being considered³⁸. This is also the default mode network brain region that helps run simulations. It simultaneously contributes to running the simulations while keeping track of how the various simulations are predicted to feel if that option was chosen. At some point in a successful decision-making process, one option will begin to feel the best and it will win out over the others. You can actually see the ventromedial prefrontal cortex "light up" in brain scanners as a signal when a decision has been reached. The final decision of which option

³⁸ See (Yu, 2019)

should be chosen is a cooperative one between portions of the default mode, central executive and salience networks³⁹.

With this stage of the decision-making process, our “out-of-season apple in the orchard” decision can now come to a close. On one hand we have the option to keep walking. When our default mode network runs that simulation, it notices continuing on with our initial goal of walking through the orchard would feel pleasant. It then runs the simulation of examining the apple. It notices that satisfying our curiosity about the unusual situation would feel good. Counteracting that, it also notices the central executive network added the logic that being late to our meeting would be problematic so there is some downweighing of the option. The last thing it looks at during this simulation is how personally relevant the situation is to us. Since our self-identity is that of an apple enthusiast, the option to check out the situation gets a big upweighting. At the end of all the weighting and deliberation a final choice is finally made: the option of examining the apple is the winner since that option has been calculated to have the highest subjective value once everything has been considered. Our ventromedial prefrontal cortex “lights up” signaling that a decision to examine the apple has been made.

Step 6 - Executive Validation

Even though an option has been selected, the central executive network and the salience network do one last check of the high-level rules established at the beginning of the decision-making process⁴⁰. They check that the “logic” constraints defined earlier in the decision-making process were adhered to. For example, in the apple orchard scenario, if the final choice was too much in violation of the “I can’t miss my meeting” logical constraint, the central executive network is given a final chance to veto the decision and continue the deliberation.

Step 7 – Action

Once we have gotten to this step in the decision process, our chosen option becomes a goal. The five aggregates have completed their role in human

³⁹ See (Domenech, Redouté, Koechlin, & Dreher, 2018) and (Clairis & Pessiglione, 2022)

⁴⁰ See (Botvinick M. M., 2001) and (Hare, Camerer, & Rangel, 2009)

cognition and now the action parts of the brain take over. For simple decisions such as “should I use the small hammer or the big hammer”, the decision process will generally be quick, and the action will follow quickly after the deliberative process. For more complex decisions such as “where should I go to grad school?”, the deliberation process can be quite extended and frequently interrupted. In those complex scenarios, the resulting action might be much later in the future and could likely involve many subsequent sub-decisions and action chains extended over a period of time to implement.

The Output of Five Aggregates is a Goal

Let us now review what we have learned over the last few chapters as we have explored the five aggregates. From conventional perspective the five aggregates to be our body (*rupa*) and the processes of our mind (*vijnana*, *vedana*, *samjna*, *samskara*) which are collectively considered synonymous with “name and form” (*namarupa*). In the *Vibhanga Sutta* (“Analysis Discourse” - SN 12.2), the Buddha makes the connection between identity (name), the ability to perceive and process reality and decision making explicit:

“And what are name and form? Feeling-tones, perception, intention, contact, and application of mind. This is called name...”

In other words, our abilities to sense external reality and process it in a way that produces intention are tied in this way to our conventional sense of being and identity. Our differentiating awareness provides the context for us to experience having a body which in turn can experience pleasant and unpleasant feeling tones. We perceive objects in the world around us that we contact through our senses and have the ability to name and categorize them based on past experience. All of the capacities allow the mind to process reality and make decisions on how to behave in a way that minimizes discomfort and maximizes comfort and pleasure. When working together, the five aggregates coordinate as processes that allow us to perceive the world around us and make determinations about how to interact with the objects and scenarios that we encounter.

This all makes sense if we remember why brains exist in the first place. Animals have brains in order to accomplish essentially what the five aggregates do: perceive the world and then determine the best way to interact

with it in order to facilitate survival. The role of the five aggregates stops before the “action” part of this functioning, but they exist to provide the body with the activity decision that it needs to perform to facilitate survival. The decision of what facilitates survival is determined by selecting an option that has the highest predicted value. Which option has the highest predicted value is determined by considering many factors and a major factor revolves around our sense of self. Once we have selected an option, we now have a goal. You can also say we have a goal or have an expectation. We have decided what we want to have happen in the future and have made a prediction of what the potential beneficial consequences are of that decision.

Every Encounter is a Decision

So far we have looked at scenarios where a person needs to decide between two or more options, but it’s important to understand the decision-making process applies to all types of encounters we can have in life. Let’s say you are walking down the street, and a seemingly mentally ill person starts yelling at you and is heading in your direction. Or imagine you are relaxing at home, and you get a phone call that your favorite aunt has passed away. Or imagine you check social media and discover a group of friends that you felt you were close to all went on vacation together without inviting you. Or maybe you are just sitting there relaxing, and you randomly have the thought you are not worthy of being loved. In all such situations the brain has to process the scenario and try and come up with an appropriate response. The same underlying mechanisms described in this chapter still are used to process these events. The same underlying cognitive machinery is at work in all scenarios where the brain processes sensory information and then must determine a response based on what it has learned from past experience, we will call all needed responses a “decision”.

7 - DIFFERENTIATING AWARENESS (VIJNANA)

To continue using our scenario of walking through an apple orchard to illustrate the working of the five aggregates, let's consider the fact that when you are perceiving the orchard and everything in it, your brain effortlessly and seamlessly is able to identify that the objects and scenarios that it perceives are discrete entities. The awareness that the objects and scenarios that we perceive through our senses are distinguishable from each other is *vijnana*. For example, if we come upon some dried flowers, we can perceive how they look through our eyes and how they smell through our noses. *Vijnana* is the pre-cognitive knowing that these flowers are being experienced as separate from other objects. To put it in the language of science, it is the ability to construct a mental representation of external objects through multi-sensory integration of perception and know that it is happening in real time.

Consciousness and Awareness in Buddhism

Vijnana is often translated as "consciousness" in translated Buddhist texts, so it is worth taking a moment to step back and take a wide angle look at how Buddhism views consciousness, awareness and related mental phenomena before defining *vijnana* specifically. The main terms used in Buddhism to describe the various facets of sentience, mind and consciousness are *citta*, *manas* and *vijnana*.

In this book I will be using these general translations for these terms:

- **Citta** – Consciousness.
- **Manas** – Mental activity.
- **Vijnana** – Differentiating awareness.

We will look at each of these terms in turn to explore their definitions and how they relate to each other.

Citta Consciousness

The word that I feel comes closest to the Western understanding of “consciousness” is “*citta*” (pronounced “cheetah”). When we mention “consciousness” in this book we are referring to *citta*. In Chinese, *citta* is transliterated as “*xin*” (心) and in Japanese “*shin*” (心). *Citta*, *xin* and *shin* are sometimes translated as “mind” or “heart-mind”.

When we look specifically at the Early Buddhist suttas or Mahayana suttas it can be hard to find a clean definition of *citta*. It is one of those terms that the Buddha clearly assumed his audience of religious and philosophical adherents already understood and thus no definition would have been necessary. As is often the case with these undefined terms, it can be helpful to look at the Upanishads to see how the terms were used by society in works that were contemporary to or predated the Buddha’s life. An Upanishad we can look at is the *Chandogya Upanishad* which includes this text:

Citta (consciousness) is indeed greater than saṅkalpa (will). For when one cognizes, then one wills. Then one reflects with mental activity (manas), then one sends forth speech, and one sends it forth in a name.

The next section of this text goes on to say:

All these [will, mental activity, speech] have citta (consciousness) as their common course, have citta (consciousness) as their essence, and are grounded in citta (consciousness).

In these excerpts, *citta* is placed at the beginning or center of a hierarchy of mental activity. It is the context under which other mental activities such as will, intellectualization and speech formation can function. The contemporaries of the Buddha would have seen *citta* in this light.

A Mahayana Buddhist source can also be looked at that shows this “context” type usage. In a Chinese Mind-Only School work entitled *Cheng weishi lun*, there is this formula:

"Collecting-and-arousing is named citta (心); thinking is named manas (意); knowing is named vijñāna (識)."

Citta is classified as "Collecting-and-arousing" because in the Mind-Only school of Buddhism they have the concept of core consciousness (*ālayavijñāna*) being the container or context where seeds of past experiences can take root to manifest in the present. In other words, it is a core contextual space in which the functions of mind operate.

Zen sources can also point to this contextual background nature of *citta* consciousness. One example, the *Platform Sutra of the Sixth Patriarch* says:

The capacity of the mind (consciousness; xin) is vast and great, just like empty space, without borders or boundaries. It is neither square nor round, neither large nor small, neither blue, yellow, red, nor white... Empty space can contain the sun, moon, and stars, the great earth, mountains, and rivers, all grasses and trees, evil people and good people, evil phenomena and good phenomena, heavens and hells—all are entirely within space.

Citta's contextual nature is often illustrated with the analogy of a mirror. For example, the Chinese Zen master Yongming Yanshou says in the *Zongjing Lu* (*The Record of the Source Mirror*):

Raising up the one mind (citta) as the essential principle, it illumines the ten thousand dharmas like a mirror.

Looking at the Chinese character 心 that was chosen to translate the Indian word *citta* also gives some clue of how *citta* was understood at the time. That character is a pure pictograph rendering of a heart. The analogy here is that *citta* is the heart, core or center of reality. It is raw consciousness which contextually hosts sentient experience.

As a quick aside, I often see the concept of heart-mind explained as a combination of our mind and our body/emotions by Zen and other Buddhist teachers, but this reflects more of Descartes's dualistic views about reality that have persisted in our culture than they reflect an accurate translation of the Buddhist term. When "heart" is used in an ancient Buddhist context they are talking about the ideas of "core" or "source" or "fundamental". They are not speaking of our emotions. *Citta* is the core heart of awareness that is the context of all experience.

The Science of Citta Consciousness

When we discuss the science of consciousness, it is helpful to distinguish if we are talking about the “why”, the “where” or the “how”. The “why” of consciousness is an inquiry into why nature would develop consciousness in the first place. The “where” is an investigation into what parts of the brain seem to correlate with consciousness experience. The “how” of consciousness asks how the physical matter in the brain creates consciousness experience.

The hardest of these questions to answer is the “how”. In fact, the scientific community calls it the “hard problem of consciousness”. The simple truth is that the scientific community seems to have no idea how consciousness is generated from matter. Given how far we are from solving this problem, some thinkers wonder if we are conceptualizing the source of consciousness in a backward manner. Maybe matter is not the source of consciousness after all. One example of this type of theory is the concept of Panpsychism. This theory is built around the idea that consciousness does not need to be created by matter due to the fact that consciousness is a basic feature of the physical world, not something that suddenly appears when created from physical processes in an animal’s brain. From this perspective, even very simple objects like atoms or electrons have simple “inner” aspects of being. This is extended to conceive the idea that complex minds like ours are built out of huge numbers of these basic pieces of consciousness working together. That doesn’t mean rocks think or feel the way we do; rather, their parts might have very primitive forms of experience that, by themselves, are nothing like human awareness but are awareness, nonetheless. Panpsychists support this approach because it bypasses the dilemma of how a completely non-conscious universe could somehow produce consciousness from scratch. Instead of coming from nowhere, consciousness is there all along in very simple forms and becomes more complex as the physical systems that contain it become more complex.

Another similar point of view is a theory called Conscious Realism that has been proposed by neuroscientist Donald Hoffman. He also argues that consciousness is fundamental but goes further to argue that what we assume is an accurate perception of the “physical world” is more like a user interface than an objective reality we directly perceive. In his view, our senses don’t show us the world as it really is; instead, evolution shaped them to show us a simplified, useful “desktop” that helps us survive, not the underlying truth. Just like icons on a computer screen hide the messy circuits and code, colors, shapes, and objects hide whatever deeper reality

actually exists. Conscious agents (beings with experiences and the ability to act) are, for Hoffman, the basic building blocks, and space, time, and matter are patterns that arise in the interactions between these agents. So instead of consciousness coming out of matter, he flips the picture: matter and the world of objects are appearances within a deeper network of interacting conscious agents.

There are other emerging theories that don't really try and flip the script. They attempt to explore consciousness as an emergent property of matter. Global Workspace Theory (GWT) proposes that consciousness works somewhat like shared memory in a computer system or shared bulletin board in an organization. This theory recognizes that many specialized brain processes operate outside awareness. They handle tasks such as recognizing objects, interpreting sounds, retrieving memories, and guiding physical body movements. These processes compete for access to a limited "global workspace." When one piece of information wins that competition, it becomes accessible to systems involved in attention, memory, decision-making, language, and action. That widespread sharing is what the theory identifies with actual conscious experience. As an example, our brains may process many background noises without awareness, but when we hear our name, that information can enter the workspace and influence what we remember, think, say, and do. This theory therefore explains consciousness mainly as information becoming globally accessible, rather than as something produced by one single brain region.

Another theory is the Integrated Information Theory (IIT). It is a framework that proposes that consciousness emerges naturally whenever a system's information is both highly complex and deeply interconnected. To get a sense of the idea behind the theory, think about the difference between a digital camera and your brain. A camera can capture millions of pixels of an apple, but it doesn't "experience" the apple because those data points are completely isolated from one another. In contrast, your brain combines various facets of the apple's reality such as its red color, round shape, and crisp smell into a single, unified experience that cannot be pulled apart. IIT argues that this unbreakable unity is how consciousness materializes. The theory even uses a mathematical score called phi to measure the conscious complexity. The more deeply a network's information is integrated together, the higher its phi score, and the more conscious that system becomes.

These are certainly all interesting theories, but they do not truly solve the hard problem of consciousness. Panpsychism and Consciousness Realism avoid the problem of how consciousness emerges from matter by making it fundamental to the universe. Integrated Information Theory is

arguably more a way of quantifying consciousness as opposed to explaining how it emerges from matter. If we are looking for a theory on “how” consciousness is created, we simply don’t have any clear answers at this point. It may be that consciousness is indeed a first-order property of the Universe, and it is not created from physical matter or perhaps it does come from physical matter, but we have no idea how that may happen. I also sometimes wonder if the source of consciousness might simply be beyond the scope of what we can comprehend. Just as my dog can never understand the concept of the New York Stock Exchange, maybe we just lack the cognitive capacity to understand consciousness from a conceptual perspective.

While science does not currently have any answers for us regarding the “how” of consciousness, we do have better luck on the “why”. The “why” revolves around an idea that consciousness is an ancient evolutionary development and exists to process feeling sensations for survival purposes. Neuroscientist Antonio Damasio is arguably the leading proponent of this point of view. In books such as “Self Comes to Mind” and “Feeling and Knowing”, he argues that consciousness is an evolutionary adaptation to manage homeostasis. To explore this point, let’s revisit an idea that we explored earlier: the primary way an organism maintains its survival is through the maintenance of homeostasis. Homeostasis can only be maintained through an organism’s actions which are coordinated by its brain, and we know that brains exist for the purpose of movement based on perception. Damasio argues that consciousness is needed to process the feelings that emerge from our internal senses.

One way I like to think about this is: An organism’s brain influences itself through pleasant and unpleasant feelings as punishments and rewards. But “what” or even “who” is the audience for these rewards and punishments? A rock does not care if it feels good or bad, for example. You can’t punish something that isn’t aware of the punishment. You cannot reward something that is not aware of the reward. From this perspective, consciousness exists as a complement to the brain systems that manage reward and punishment. If you give an organism some flexibility in decision making in order to deal with unexpected scenarios, it also makes sense to also nudge its behavior towards what evolution has determined is conducive to survival and procreation. Pleasant and unpleasant feeling sensations are the nudges, and conscious awareness is what is being nudged. This theory explains the “why” of consciousness. Conscious awareness exists so there can

be a sentence that can be targeted and influenced by feeling-tone-based rewards and punishments⁴¹.

Having temporarily given up on the “how” of consciousness but having fruitfully explored the “why”, we can now turn to the “where”? As it turns out, there is some convincing evidence that points to the physical neuro correlates of conscious awareness. Let’s first consider that initially many researchers and commentators speculated that consciousness is a “higher order” cognitive phenomenon and as a result is likely to be processed by the more modern and complex regions of the brain in the neocortex. The neocortex is the most recently expanded part of the brain and it grew substantially in size and complexity during the evolutionary history of primates. This view is probably highly influenced by the Cartesian view that humans are the sole owners of “consciousness” and other animals are merely mindless biological automations. If humans are the sole owners of consciousness and an advanced neocortex is what makes us human, it would make sense that the neocortex is the seat of consciousness.

There is another way to look at this, however, that places consciousness at a more fundamental level of animal development. This is the idea that instead of consciousness being a recent evolutionary adaptation that exists in higher order animals, consciousness exists in most animals and is evolutionarily ancient. A starting point when exploring this point of view is recognizing that one consequence of the idea that consciousness exists to be aware of feelings is that any organism that has the neurological machinery for the felt sensations of punishment and reward likely also has the neurological machinery for consciousness. As it turns out, there is indeed meaningful evidence that consciousness is controlled by the evolutionary oldest part of the brain. These ancient brain regions also control the basic mechanisms for feeling-based rewards and punishments.

A good summation of the idea of an ancient and primitive biological seat of consciousness is a paper entitled “A review of the sufficient conditions for consciousness” by the Cambridge University neuroscientist Peter Coppola. In this paper he reviews decades of studies and concludes that core consciousness is primarily mediated by ancient evolutionary brain regions such as the brainstem, thalamus and hypothalamus. He comes to this conclusion based on a convergence of evidence showing that these structures are sufficient for generating the fundamental “feeling of being,” even when the cortex is absent or dysfunctional. Specifically, his review

⁴¹ See (Cabanac M. , 1992), (Cabanac M. , 1996) and (Godfrey-Smith, 1996) to explore see support for my ideas in this paragraph.

highlights that neurostimulation of the brainstem and thalamus can reliably abolish or induce the state of consciousness, whereas cortical (primate brain) stimulation typically only alters specific contents. He also points to hydranencephalic children (born with almost no cortex) and animals who have had their cortexes severed, who retain wakefulness and are able to display complex, emotionally motivated behaviors such as play, mating, and feeling responses. This demonstrates that the homeostatic and interoceptive functions housed in more ancient parts of the brain are sufficient to support a basic form of subjective experience.

Looking at animals beyond vertebrates we can see that other types of animals are capable of experiencing rewarding and punishing feelings as well. Evidence suggests that animals such as insects and octopuses, which have extremely different brain structures than ours, are likely to feel pain. Since the punishment of pain requires an “audience” for it to be meaningful, consciousness presumably dates back to the common ancestor of all brain-having creatures, and this ancestral valence mechanism has been elaborated in many different ways.

Before we move onto the next section, it is worth noting that when we say a creature has “consciousness” we are not claiming that it has a perceived sense of self as it exists in humans. In fact, a large part of this book works towards disassociating a sense of self from baseline consciousness. A “self” and “consciousness” are not synonymous terms as modern western science often assumes and as our day-to-day experience might indicate.

Manas Mental Activity

If *citta* is the contextual substrate for mental activity, *manas* is the mental activity itself. The term *manas* generally represents the cognitive and emotional content of *citta*. When we have thoughts, feelings and opinions, these are *manas* content happening within *citta*. You can think of *citta* as the movie screen and *manas* as the movie. *Manas* can also be thought of as any mental representation that is not coming through the active senses.

Vijnana as Differentiating Awareness

Now that we have set the stage of defining *citta* consciousness and having looked at its purpose and neuro correlates, we can explore the Buddhist concept of *vijnana*. Like *manas*, *vijnana* operates within the context of and is supported by *citta* consciousness. *Vijnana*, at least in my opinion, is best

translated as “differentiating awareness”. In the *Khajjanīya Sutta* (“Being Devoured Discourse” - SN 22.79), the Buddha has a fairly straightforward definition of *vijnana*:

“And why, bhikkhus, do you call it differentiating awareness? ‘It is aware [discriminates],’ bhikkhus, therefore it is called awareness. And what is it aware of? It is aware of sour, it is aware of bitter, it is aware of pungent, it is aware of sweet, it is aware of sharp, it is aware of mild, it is aware of salty, it is aware of bland. ‘It is aware,’ bhikkhus, therefore it is called differentiating awareness.

We can see here that this aggregate is aware of or “knows” objects and their basic attributes. This is more than a mere mechanical sensing of objects but a cognizant knowing that an object is being perceived. At a very high level, if you look at an apple on a tree and recognize that there is perception of an object, you are experiencing *vijnana*.

This dualistic/differentiating nature of *vijnana* is embedded in its name: “*vi*”-“*jnana*”. The prefix “*vi*” means “split”, “separate” or “dual” and “*jnana*” means “awareness” or “knowledge”. Because of this etymology, I like “differentiating awareness” as a translation instead of just “awareness”. Most people in the Zen world translate *vijnana* as “consciousness” but I think that conflates it with *citta* and does not fully represent the dualism in the source term of “*vijnana*”.

There are six types of *vijnana*. One for each sense base:

- Eye differentiating awareness
- Ear differentiating awareness
- Nose differentiating awareness
- Tongue differentiating awareness
- Body (feeling) differentiating awareness
- Mental activity differentiating awareness

Mental activity (*manas*) is included as a sense base because we can be aware of mental objects/phenomena such as thoughts, memories, emotions and ideas. The memory of a tree for example would be a type of differentiating awareness of “mental activity” while the visual perception of a tree itself would be a type of “eye” differentiating awareness. *Vijnana* is most often translated as “consciousness” but in my opinion, that is a bad translation that has been perpetuated over the years. As we have seen, *vijnana* is very specifically based around knowledge of sensory experience and is not

about general sentient consciousness. That type of cognition has more to do with *citta*.

The awareness within *vijnana* is “differentiating” because it mostly centers around the perception of objects as differentiated from other objects through the senses in a pre-conceptual manner. It’s not applying the label “apple” to an object. That is *samjna*. It’s not about identifying a particular apple and having opinions or stories about apples in general. Those are other types of cognitions we will discuss later in this book. It is simply about the discrete separability of objects within conscious awareness.

The Science of Differentiating Awareness

When looked at from a scientific perspective, I propose that *vijnana* differentiating awareness corresponds to the step of perception that takes place after raw sensory input but before semantic interpretation. “Semantic interpretation” is when we assign names, categories, associations and meaning to what we are perceiving. We looked at what amounts to semantic processing in the “Perception (*Samjna*)” chapter. Before the semantic *samjna* stage, we first need to have an internal representation of an object that is being held in the mind that is processed and assembled in the high-level sensory cortex regions of the brain.

When we perceive the world through our senses the information initially comes in as a jumbled mess. The first step in sorting out this random information is to divide what we are perceiving into manageable elements⁴². For example, in the case of sight, we break random light signals into elements such as colors, edges, surfaces, etc. Then we group these elements together into discrete objects. For example, if we are viewing an apple hanging on a tree, the brain needs to sort some of the visual elements together as an apple and separate them from the nearby “branch” object which has its own elements that are sorted and combined together. Once individual objects are defined, the next step is to sift through the different senses and associate them together if they come from the same object⁴³. For example, if we are perceiving a singing bird, the brain at some point needs to combine the visual image of the bird with the sound it is making so a complete representation of the object can be made.

⁴² See (DiCarlo, Zoccolan, & Rust, 2012)

⁴³ See (Stein & Stanford, 2008)

We saw in the *citta* section discussion that conscious awareness likely involves the thalamus, so integration with that brain region would be necessary for the object representation to be actually conscious in a sentient sense. As the perceptual process progresses from raw data to a coherent object representation, the high-level cerebral cortex areas involved in object perception and the thalamus repeatedly exchange signals through what we call “corticothalamic loops” as a stable representation of the object is being constructed⁴⁴. When this looping activity becomes sufficiently organized and stable, the object becomes consciously present as something distinct from its surroundings⁴⁵. A key player in this mental representation of a perceived object is the inferior intraparietal sulcus⁴⁶. There is no need to memorize that brain region right now, but I am calling it out here because we will refer to it later in a key passage towards the end of the book.

⁴⁴ See (Ward, 2011)

⁴⁵ See (Xu & Chun, 2006, 2009)

⁴⁶ See (Xu & Chun, 2006, 2009)

Part 2 - Self, Other and Desire

8 - SELF-PERCEPTION (ATMAN)

This chapter explores the conventional “sense of self” from both the Buddhist and neuroscientific perspective. We first look at self-related definitions in Buddhism and then explore dimensions of self from a scientific perspective. These dimensions of self also us the opportunity to create a useful framework to explore why we suffer and what the solution is to this suffering later in the book. Lastly, we look at the idea of “dualistic conceptualization” and see how it is one of the core ways that our perceived sense of self participates in the five-aggregate process.

Self, Individuality and Identity in Buddhism

As a starting point, it needs to be acknowledged that one of the core tenets of Buddhism is that the way we normally perceive a “sense of self” is illusory. We will address why a sense of self is ultimately illusory in detail later in the book, but for now we are going to focus on how and why a conventionally perceived “sense of self” in humans exists in the first place. We are going to explore the ways in which a perceived “sense of self” helps us survive in the world.

Before we dive into the science of self, let’s spend a moment looking at how a “sense of self” and a sense of individuality is presented in the Early Buddhist teachings⁴⁷. The first self-oriented Buddhist term we are going to look at is “*gandhabba*”. It is often stated that in Buddhism, “there is no soul”. Because it is often repeated, many people are surprised to find out that in Buddhist sutras there is actually something somewhat like an individual soul. It is called the *gandhabba*. Traditional Buddhism thinks of it like a stream of karma and consciousness that links one life to the next. Unlike the

⁴⁷ See (Buswell & Lopez, 2013) for definitions of various notions of self in Buddhism

conception of a Judeo-Christian soul, the *gandhabba* is not unchanging and it is not eternal. It is subject to causes and conditions just like anything else in the universe.

In traditional Buddhist belief, once a *gandhabba* has entered a body and the new human exists, it would now be considered a *pudgala*. *Pudgala* is best translated as “an individual”. This is the concept that is inherent when the Buddha referred to himself in the first person or directly and explicitly referenced other people. The concept of a *pudgala* is a conventional way of conceptualizing that other people exist as individuals. In the Early Buddhist texts, there are hundreds if not thousands of instances where he referred to himself in the first person and made reference to other people as individuals. In a conventional sense, the Buddha had no problem with cognizing the idea of an individual while communicating on a day-to-day basis.

Next, we will look at the term *atta* (*atman* in Sanskrit). Linguistically, in the Early Buddhist teachings, if there is a sentence that needs a term that means “oneself” and sometimes “myself”, the word *atta* (*atman*) will be used. For example, in Dhammapada 165, there is the quote, “By oneself is evil done; by oneself is one defiled”. The word *atta* (*atman*) linguistically allows us to refer to ourselves as a reflexive pronoun. It assumes a subjective entity with a sense of agency. There is also a lot of historical baggage around the use of this term in the Early Buddhist sutras. In the religious world that preceded and was contemporary to the Buddha, *Atta* (*Atman*) with a “capital A” referred to what could best be described as a universal and timeless soul. This was the context of a lot of his teachings on the concept of self (or the lack thereof).

Another self-related term is *sakkaya ditthi* and this term is the one that is most relevant to the discussion in this book. This term is sometimes translated as “self-view” or “personality-view”. Somewhat confusingly, Bhikkhu Sujato translates it as “substantialist view”. “Self-view” is probably the most accurately descriptive and also the most commonly used translation so we will go with that for this book. As “view” implies, *sakkaya ditthi* can be seen as a perceptual perspective. It is the perceptual perspective that the five aggregates, collectively, seem to define who and what we are as individuals. It is the perceptual experience that having a body and having a volitional mind is fundamentally what our identity is. This is why a synonym for the five aggregates is *namarupa* or “name and form”. Self-view is the subjective and conventional experience that our sense of self is correlated to the functioning of body perceptions, dualistic consciousness, pleasant and unpleasant feelings, perceptions and volitional decision making. It is the active phenomenological perception that we have a body that hosts a mind.

A Conventional Sense of Self Emerges from and Because of the Five Aggregates

From a conventional and neurological perspective, it makes a lot of sense that a conventional sense of self and identity would be correlated with the five aggregates. This is because when we were looking at the decision-making (samskara) aggregate, we saw that many of the inputs into the decision-making process revolved around a sense of self identity or the need to determine what is important from a self-referential perspective. From a scientific and evolutionary perspective, this is why a sense of self needs to exist at all: as critical inputs into our brain's five-aggregate decision-making process. You could say the primary place that that sense of self "lives" and works within is inside the activity of samskara (decision-making) aggregate.

In humans, a self and the five aggregates are especially linked to each other. Simple animals don't need much of a sense of self at all since their decisions are themselves simple. But as a species' survival strategy increases in complexity, it requires an increasingly sophisticated understanding of what is expected and needed from the world from a self-referential perspective. In the case of humans, our core survival strategy involves two major components. The first component is the ability to conceive of plans that take place over very long periods of time. The second component is intensely complex and dynamic social cooperation and competition with other humans. This is why our sense of self is so social in nature and why our self-related thinking often involves vast timescales.

The five aggregates are created by our brain to perceive and react to the world and if the five aggregates did not exist, there would be no need for a socially and time-traveling oriented sense of self at all. Our brain's obligation to make decisions and problem solve and then communicate the results of those tasks to other people is what necessitates the rich and complex sense of self that we have.

This connection between the five aggregates and a perceived sense of self manifests perceptually. From a conventional perceptual perspective, it really does seem like we have a body that hosts a self. A self that can feel sensations, perceive sensory phenomena, name those phenomena and dualistically know that we are an object in a world of objects in order to make decisions on how to interact with reality. This is how a normally functioning brain perceives the relationship between body and mind.

A Framework for Categories of Self

We will next look at a framework of different levels of “self” that combines perspectives from neuroscience, psychology and philosophy in a way that will help us explore the implications of self-perception later in this book. We normally experience “self” as a unified perception, but we will see that this perception is actually an amalgamation of many different types of self-experience and self-perceptions.

The Essential Self

“Consciousness without boundary, without end, luminous all around” - Kevaṭṭa Sutta (“Kevaṭṭa Discourse” - DN 11)

Many scientists believe that the brain maintains a base “minimal”, “core” or “embodied” self. It is the real-time perception of existing, and it is intimately tied with a pre-cognitive feeling being alive. In this book we will call it the essential self. “Embodied” self is a term used by some neuroscientists, but we use that term here for another dimension of self.

The essential sense of self is the perceived sense of existing “right now”. It contains no sense of time, boundaries or conceptualization. It is functionally equivalent to the level of *citta* consciousness we described in the Differentiating awareness (Vijnana) chapter. Some scientists such as Antonio Damasio describe this level of consciousness as being where the sense of “I” comes into being, but as we will see soon, this aspect of existence really manifests when there is a continuous sense of self. Though it is routine for Buddhists, I think many Western scientists don’t even consider that there is a layer of conscious awareness that can exist separately from a sense of “I”.

As we saw in the introduction chapter, there is good reason to believe that this base awareness is represented in the brain by brainstem, thalamus and hypothalamus. These evolutionarily ancient brain regions are shared by all vertebrate animals and likely generate a sense of awareness so that there is an audience for rewarding and punishing sensations that are intended to motivate behavior towards survival and procreation. I feel that in many animals, and certainly in the case of humans, the awareness that the brainstem, thalamus and hypothalamus represent can be seen as the “movie screen” of consciousness. All of the regions and networks in the brain that

produce “conscious experience” do so in coordination with the thalamus⁴⁸. These connections are called “thalamocortical loops” and these brain circuits are proposed as essential for any region that wants to contribute content to real-time awareness⁴⁹.

The Buddhist concept that probably maps best to this level of self is *citta*. It is the foundational level of non-“I” self that is the context of all consciously aware experience.

The Embodied Self

*“They...regard a body as self, self as having a body, a body in self, or self in a body.” – Nakulapitu Sutta
 (“Nakula’s Father Discourse” - SN 22.1)*

An embodied sense of self is functionally equivalent to the *rupa* aggregate. As a review, let’s remember that the perception of an embodied sense of self is a combination of three distinct perceptions: the creation of a body schema and the feeling of body ownership. The first is perception of a body schema, which functions as a dynamic internal map of all your movable parts and the space they occupy, constructed moment by moment in the posterior parietal cortex. This model relies on a stream of sensory data to predict where the body will be, yet it remains a flexible, best-guess construction that can even be reshaped by visual tricks like the rubber hand illusion. The second component of the embodied self is the specific “knowing” or self-awareness that the body belongs to you. This distinct sense of ownership is mediated by the insula, a brain region responsible for making a body part feel like “self” rather than an external object, ultimately allowing the brain to finalize the dualistic segmentation of reality into “body” and “not body”. The third type of perception is interoception. This is sensory awareness of the internal state of the body. Body schema is largely mediated by the posterior parietal cortex. Body ownership and interoception are largely processed by the insula.

⁴⁸ Some argue that olfactory awareness can bypass the thalamus for brain representation but see (Plailly, Howard, Gitelman, & Gottfried, 2008) for evidence that thalamic connection is necessary for “reportable” smells.

⁴⁹ See (Zepeng, Yuanyuan, & Mingsha, 2025)

The Perspectival Self

"When walking, he discerns, 'I am walking'; when standing, he discerns, 'I am standing'; when sitting, he discerns, 'I am sitting'; when lying down, he discerns, 'I am lying down'; or in whatever way his body is disposed, he discerns it accordingly." – Satipatthana Sutta ("Establishment of Mindfulness Discourse" – MN 10)

While the embodied self is the perception of "what" our body is, the perception of the perspectival self is "where" our body is. Our brain needs specific circuitry to figure out how we fit into the physical scene we, as an entire body, are located relative to what we can view in our immediate surroundings. Again, one might think this would be obvious just from perception, but the brain is not a general-purpose computer. It needs functionality-specific neural circuitry for everything it does, and body location is no exception.

We stated earlier that the default mode network is integral to our experience of being a self, but you may have noticed that so far when investigating the essential and embodied selves, it has not come up in the discussion. It is here, when we look at the "perspectival self" that the type of self that the default mode network specializes in comes into play. The first two types of selves are about real-time embodiment but starting with the perspectival self, cognition is more related to the self in the context of the larger world. This context can be abstract and narrative or it can be physical and spatial from a first-person perspective.

When we are talking about perspectival self, we are looking at it from a first-person spatial perspective. This creates a physical subjective dualism that is necessary for survival. We need to be able to envision a scene and then place ourselves in it in order to successfully interact with the world. One of the ways that the default mode network does this is that it puts us as an "actor" into a "scene" from a first-person perspective. If you can close your eyes and imagine the scene that you are in and imagine how your perspective could change within it, key components in the rear sections of default mode network are contributing to this type of cognition.⁵⁰

⁵⁰ These are the precuneus (Dordevic, Hoelzer, Russo, García Alanis, & Müller, 2022) and posterior cingulate cortex (Baldassano, et al., 2017).

To get a sense of the role that these default mode regions play, we can revisit our stroll through the apple orchard from the previous chapter. As we are walking through it, we are not just reacting to the visual scene as we are encountering it or just concentrating on what we can reach with our hands, we have an abstract model of the whole scene in our minds. Even the parts that we cannot see or have never seen. We can picture what it looks like behind us and can picture ourselves anywhere in it. This is all the workings of the default mode network. We talked about how the brain is a simulation machine and the default mode network is hard at work here simulating a model of the scenario we are in from a first-person perspective.

This capability comes in very handy when we need to simulate something happening in the scenes our default mode network can model. In the apple orchard scenario, we could simulate the scenario of going up to the apple in our current scene and we could also imagine a scene nowhere near our current location as we simulate what it is like to go home and have our meeting. Our default mode network can build simulated scenarios in other places and in other times. It does all this from a first person dualistically subjective perspective.

It is important to recognize that the default mode network is not just building and simulating scenes; it adds the experiential quality of “existing” in them. It takes a “sense of self” and makes the scenes perceptually personal. This can be seen experimentally when scientists disrupt the default mode network regions we are talking about. And this is also where the distinction between the embodied self and the perspectival self can get a little blurry. One region that is involved in imaging future scenarios along with the core default mode network regions is the anterior precuneus. It is also highly connected and coordinated with brain regions that process embodied-self representations. It seems to be the region that bridges an embodied self and a perspectival self⁵¹.

In a study at Stanford University⁵², researchers found themselves in a rare medical opportunity involving nine participants who were undergoing pre-surgical monitoring for drug-resistant epilepsy. These patients already required the implantation of electrodes in their brains to identify the source of their seizures, so the scientists had access to the default mode regions we have been talking about with very precise accuracy. This setup gave researchers the capacity to apply direct electrical stimulation to individual

⁵¹ See (Lyu, et al., 2023)

⁵² Again, (Lyu, et al., 2023)

brain regions in order to establish evidence for what each of these brain regions actually does.

When they stimulated the anterior precuneus, strange experiences were reported by the experimental subjects. Some subjects felt like they were floating or falling. Some felt like they lost their personal connection to their bodies. There are quotes from subjects like “my body left me”, “The system I know as ‘myself’ leaves my body” and “I got pulled out of the cockpit... or, I got pulled out of the chair, the pilot’s chair, but I could still see all the gauges”. Stimulating this region disrupted both embodied and perspectival self. However, we can notice it did not disrupt the sense that they existed in general. There was still an “I” that was or was not connected to the body. There was still an “I” that had a normal or abnormal perspectival self. The embodied and perspectival selves work together to place the “I” into existing or imagined scenes but the “I” itself is another level of self and that level of self is the continuous self.

The Continuous Self

“There is, bhikkhus, the mind, there are mental phenomena, there is the element of ignorance. When the [unenlightened person] is contacted by a feeling born of ignorance-contact, ‘I am’ occurs to him; ‘I am this’ occurs to him; ‘I will be’ and ‘I will not be,’ ...these occur to him”. – Samanupassanā Sutta (“Ways of Regarding Discourse” – SN 22.47)

A continuous sense of self is the perceived sense that an individual has existed in the past, exists now in the present and will exist for at least the immediate future. It is a sense of personal continuity through time. It is a felt sense of existence that fundamentally depends on something called episodic memory⁵³. Episodic memory is the ability to remember specific experiences (like your first day at college). This type of memory is the key to the phenomenon of feeling like we exist because otherwise, how would we know we once existed if we had no memory of it? With no memory of previously existing, each moment of life would seem to be the first thing we had ever experienced, and we would have no sense of continuity. As it turns out, this condition is not just conjecture. Within neuroscience, there is the well-known case of a man named Clive Wearing who, unfortunately, had a

⁵³ See (Prebble, Addis, & Tippett, 2012)

severe brain infection and as a result lost his ability to retain memories for more than just a few seconds due to the resulting permanent brain damage. Without the ability to form new episodic memories, he lost his continuous sense of self⁵⁴.

While he retained some limited ability to recall episodic memories (like the fact he had a wife) that occurred prior to his infection, any new memories vanished from his mind after a few seconds had passed. When asked what his experience of life was like he would say things like, “I haven’t heard anything, seen anything, touched anything, smelled anything. It’s like being dead.” He often explained that he did not feel like he truly existed. He kept a journal after his illness and the entries would often be just a few minutes from each other and would be something similar to “I am awake”, “I am conscious”, “2:10 P.M: This time properly awake”, “2:14 P.M: this time finally awake.” and “At 9:40 P.M. I awoke for the first time, despite my previous claims.”⁵⁵ He would often cross out previous entries. There are hundreds of such pages in his journal.

Here is an excerpt from an interview he once gave:

[Wearing] You’re the first human beings I’ve seen, the three of you. Two men and one lady. The first ... people I’ve seen since I’ve been ill. No difference between day and night. No thoughts at all. No dreams. Day and night, the same – blank. Precisely like death.

[Interviewer] Is it very hard?

[Wearing] No. It’s exactly the same as being dead, which is not difficult, is it? To be dead is easy. You don’t do anything at all. You can’t do anything, when you are dead. It’s been the same. Exactly.

[Interviewer] Do you miss your old life?

[Wearing] Yes. But I’ve never been conscious to think that. So I’ve never been bored or upset. I’ve never

⁵⁴ See (Seth, 2021)

⁵⁵ See (Sacks, 2007)

*been anything at all, it's exactly the same as death. No dreams even. Day and night, the same*⁵⁶.

His case is illustrative in that it indicates that episodic memory processing is highly involved in a sense of continuous self and there are examples of amnesia messing with people's ability to sense self-continuity. One is a subject known as Patient H.M.⁵⁷ who underwent a surgical removal of his medial temporal lobes (including the hippocampus which is a key memory node in the default mode network) and he lost the ability to form new episodic memories. He described his experience of life as being like "waking from a dream" and "every day is alone in itself". H.M. and Clive Wearing both lost abilities to process episodic memory and both had attenuations of self-continuity but Clive's collapse of feeling of being a continuous self was more complete and profound.

Clive Wearing's example clearly indicates that the time-associated episodic memory is a crucial part of feeling like a continuous self and one interesting cognitive experience humans can have helps us paint a broader picture of how self and time interrelate. There is a concept in neuroscience known as a "flow state" and it is a psychological state of complete absorption, focus, and involvement in an activity. During flow, a person's sense of time, self-awareness, and external distractions are reduced, replaced by a deep sense of effortless engagement with activity in the present moment. An important study⁵⁸ about flow states was conducted by researchers at the University of Ulm in Germany where they put 23 healthy men in a functional magnetic resonance imaging scanner and either induced flow states, boredom or mental overload. During flow, the researchers found reduced activity in key default mode network regions compared with boredom and overload. Researchers interpreted this reduction in default mode network activity as reflecting reduced self-referential processing.

Another study connects flow states with a diminished awareness of time. In a 2022 study⁵⁹, a team of scientists investigated how flow affects subjective time by having 43 participants play the fast-paced video game Thumper continuously for 25 minutes while physiological and brain activity was being recorded. Afterward, participants rated how strongly they had experienced flow and absorption, how often they had thought about time, and how quickly time seemed to have passed. Greater flow was

⁵⁶ See (Treays, 2005)

⁵⁷ See (Milner, Corkin, & Teuber, 1968)

⁵⁸ See (Ulrich, Keller, & Grön, 2016)

⁵⁹ See (Khoshnoud, Alvarez Igarzábal, & Wittmann, 2022)

associated with being aware of the passage of time less often. They also found measurable indications that self-referential processing was reduced during the game play vs rest. The findings suggest that as people become more deeply absorbed in a flow state, their normal monitoring of the passage of time diminishes along with self-referential processing.

Putting the evidence from these studies together with Clive Wearing's experience tying continuous self with declarative memory we can begin to see what the neuro correlates of this type of self-processing might be. It points to the idea that the default mode network's ability to process memories while conceiving of the passage of time is connected with the real-time experience of a continuous sense of self.

The Volitional Self

*"Monks, it is intention that I call action. Having intended, one acts through body, speech, or mind." -
Nibbedhika Sutta ("The Penetrative Discourse" - AN
6.63)*

The volitional self is the sense that we are the authors of our own behavior. That may sound implicitly obvious, but like many things in neuroscience, specific brain circuits are necessary for us to be aware of agency. Having the perception that we are the author of our behavior has a few survival advantages. For one thing, knowing if something is happening to us or near us is due to our own actions or not is very important in knowing how to react to something. For example, if you feel something on your arm and you know whether or not it's because of your own actions, you are more likely to check for a bug crawling on your skin. Another survival benefit of a volitional self is that if you are explicitly aware of what you are doing, then you can learn from cause and effect. Lastly, if we know what we have decided to do purposely, that helps us with social accountability. Cooperation with other people requires promises, blame, punishment, and reputation. None of which work without tracking who did what. The same machinery detects your own authorship and is also used to determine agency in other people.

Many brain regions contribute to a volitional sense of self but a key node in this perception is the parietal lobe. This brain region processes sensory information such as touch, pain, and temperature, and helps coordinate spatial awareness and body position. Looking back at the embodied self section, we can remember that it was involved in body schema. There have

been a number of studies that tie the parietal lobe to agency as well. The implicated sections of the parietal lobe involved in agency play roles in the processing of the default mode network.

The first study⁶⁰ is one where French and British researchers investigated patients who had suffered strokes damaging the parietal lobe to see if their sense of agency had been affected. When healthy people are asked to make a spontaneous hand movement and then report the moment, they are aware of the urge to do so and will typically place that moment slightly before the movement itself. The parietal patients could not do this. They could report accurately when they started moving, but not when they first became aware of their intention to move. From their perspective, the will to move arrived only at the instant the movement began, rather than before it, which would normally be the case for a healthy person. The motor control with the stroke victims was fine. What was missing was prior awareness of their own intention. The result suggests that the parietal cortex is not producing the movement but producing the experience of being about to move and when it's damaged actions can still be performed but they arrive without the feeling of having been willed.

Another study⁶¹ was produced by a team working with neurosurgical patients undergoing awake brain surgery for tumor removal. During the surgery they were able to apply small electrical currents directly to the surface of the exposed brain and ask patients what they felt. When they would stimulate the right inferior parietal region, it triggered a strong intention and desire to move a hand, arm or foot. While stimulating the left inferior parietal region, this produced the intention to move the lips and to talk. When the current was increased, patients became convinced they had actually performed these movements despite not having done so. Stimulating the actual movement regions in the frontal lobe produced the opposite effect: this would cause actual visible movements of the mouth and limbs, and the patients would firmly deny having made them. The parietal lobe generated the sense of authorship without any action and the other location generated action without any sense of authorship. That separation is the strongest available evidence that the feeling of “willing” is manufactured by a specific piece of parietal machinery and is not simply a readout of the body actually moving.

⁶⁰ See (Sirigu, et al., 2004)

⁶¹ See (Desmurget, et al., 2009)

The last study⁶² we will look at involved patients who suffered from schizophrenia. Some people with schizophrenia have an unsettling symptom where they can move a body part but not feel like they are the one who initiated the movement. To them it feels as though a machine, a spirit, or some outside force moved it for them. The movement happens normally but what is missing is the sense of being the one who made it happen. Scientists call this a delusion of alien control. Researchers at a London hospital found seven patients experiencing this and scanned their brains while they moved a joystick, choosing for themselves when and where to move it. Then they waited four to six weeks and scanned them again. By the time of the second scanning, the symptoms had faded in five of the seven. When the symptoms were at their worst the right inferior parietal lobule was extremely active. When the symptoms faded, so did the excess activity in that region. This last detail is a crucial point because the overactivity wasn't a general feature of schizophrenia. It was tied specifically to losing the feeling of authorship. This is a correlation rather than proof and the scanning technology of the time was blurry by today's standards, but it points at the same small area of the brain that was relevant to the stroke patients and the surgery patients.

The Identity Self

"[For the unenlightened person] the notion 'I am' have not vanished in him. As 'I am' has not vanished, there takes place a descent of the five faculties — of the eye faculty, the ear faculty, the nose faculty, the tongue faculty, the body faculty." — Samanupassanā Sutta ("Ways of Regarding Discourse" — SN 22.47)

The identity self revolves about characteristics and beliefs about who we are and how the world works from a self-referential perspective. The identity self is a complex interconnected structure of beliefs (schema) about who a person is and what they think needs to happen in their lives and the world around them to feel safe and secure. Both the schema itself and the real-time accessing of the schema's beliefs fall within our definition of an identity self.

While a continuous sense of self is entirely episodic memory, an identity sense is based on something called declarative memory. Declarative memory is the kind of memory you use when you consciously recall facts

⁶² See (Spence, et al., 1997)

and events. Said another way, they are memories that you can “declare” out loud. When you remember the capital of Germany, your friend’s last name, or what happened at last year’s holiday party, you’re using declarative memory. Declarative memory contains the “facts” of your life and episodic memory (our ability to remember scenes from the past) adds the sense of continuity that weaves these facts into a timeline.

This complex and interconnected structure of beliefs about who a person is and what they think needs to happen in their lives and the world around them to feel safe and secure is called a “self-schema” by psychologists. A self-schema is the content of the identity sense of self, and it is managed by a different part of the default mode network than the continuous sense of self is. The continuous sense of self is mostly processed in the rear part of the default mode network, and the self-schema is managed by the frontal regions of this network. These frontal regions are collectively called the medial prefrontal cortex.

One might wonder if the medial prefrontal cortex is also part of the continuous sense of self, but the unfortunate examples of those who have damage to their medial prefrontal cortex show that this is not the case. In a study titled “*Who am I really? The ephemerality of the self-schema following vmPFC damage*” by researchers at the Università di Bologna in Italy indicates that it is self-schema that is affected by damage to the frontal sections of the default mode network⁶³. To investigate how the brain maintains a stable sense of self, the researchers recruited three distinct groups of participants. The primary group consisted of patients with damage to their ventromedial prefrontal cortex which is one part of the larger medial prefrontal cortex. They also recruited participants for two control groups: one group of cognitively healthy individuals and another group of patients with brain damage in areas outside the ventromedial prefrontal cortex. This comparison allowed the researchers to isolate the function of the ventromedial prefrontal cortex from the general effects of having a brain injury.

In the first session of the study, all participants completed a questionnaire designed to map their self-schema. They were given a list of activities, habits, and characteristics and they were asked to rate how much those elements applied to them. They were asked questions such as “are you punctual?” or “do you enjoy gardening?” For each question they asked how likely they were to possess those traits and how confident they were in that answer. To provide a baseline for comparison, researchers also asked the

⁶³ See (Stendardi, Giacometti Giordani, Gambino, Kaplan, & Ciaramelli, 2023)

participants to do this exact same questionnaire for a close friend or relative, rating that person's traits and their confidence in those ratings.

The primary goal of the experiment was to test the stability of these answers over time. After the initial session, researchers invited the participants back one week later to repeat the questionnaires. The researchers were looking to see how much consistency there was in how people answered the question across the two sessions.

The conclusion of the study revealed a fundamental role of the ventromedial prefrontal cortex in self-schema. They determined it is this brain region that keeps our identity consistent over time. While healthy individuals and the brain-damaged control group gave stable answers that matched their confidence levels, those with ventromedial prefrontal cortex damage did not. These patients showed an inconsistent self-schema, frequently contradicting their previous answers despite feeling highly confident in them. The study concluded that without the ventromedial prefrontal cortex, the self-schema is unstable and lacks the continuity found in a normally healthy person.

Going back to our apple orchard scenario, the self-schema of the identity self primarily came into play while choosing between multiple options during the *samskara* decision-making mode. If you remember, one of the considerations that the mind took into account when deciding between options was our self-understanding that we were apple enthusiasts. This was a fact about how our self-identity that weighed heavily on the final option was selected. Our self-belief regarding our relationship to apples tipped the scales in favor of investigating the anomalous apple.

The beliefs of our self-schema also play into decision making in ways other than selecting presented options. For example, they can influence what triggers a decision-making process in the first place. Things that are more important to us are more likely to catch our attention. For example, if we believe we are a "helper" we will be more likely to consider springing into action if someone is in need. The self-schema of the identity self also plays a role in what decision options we can come up with when faced with a decision we must make. For example, if we are tasked with bringing a dessert to a potluck, if we have the belief that we are a good baker, the options of making a dessert can be added to the option of purchasing one from the store. As another example, if we see someone that we consider attractive in a situation where it would be appropriate to approach them, we might not even consider the possibility if we view ourselves as unlovable or unattractive.

In general, the self-schemas of the identity-self provide us with the tools we need to consider complex scenarios over very wide temporal windows when making decisions. Self-schemas present us with options during decision making but also limit the options that we see as being available. They factor into what solutions we choose in ways we often do not even notice.

One last thing about the topic of identity self and self-schema that is worth noting is that the brain selects bits of facts or connections between facts to save into the schema based on how we feel when we encounter that information⁶⁴. For example, if we find ourselves in a nightmarishly embarrassing social situation, there is a high probability the contextual facts about that situation will be added to our self-schema. Conversely, if something brings us great pleasure, either physically or emotionally, the related perceived contextual facts of the pleasant scenario are likely to be added to our self-schema. Remembering that the *vedana* experiences of pleasure and discomfort are proxies for what the brain perceives helps or hurts our chances of survival, we can see that the identity self and self-schemas are strategies to protect us. They are feeling-based strategies that are designed to help us feel safe, secure and happy. For example, if we visit our local zoo and find it intensely boring to the point of that boredom being unpleasant, our self-schema will likely now include the notion that we don't find zoos (or maybe just that zoo) enjoyable. This knowledge can protect us from unpleasant experiences in the future. Self-schemas are a complex web of opinions about what is good for us and what is not from a pleasant (helps us survive) or unpleasant (hurts our survival) perspective.

The Social Self

"One who conceives 'I am equal, better, or worse [than other people],' might on that account engage in disputes." – "Samiddhi Sutta" ("Samiddhi Discourse" – SN 1.20)

All living organisms have a survival strategy. One of the survival strategies of the anchovy species of fish is to swim together in tightly coordinated schools so that a predator will find it difficult to isolate one individual. A survival strategy for many spiders is to weave a web in order to catch prey. A survival strategy of heron birds is to lie in wait by the shore of a body of water and ambush fish as they swim by. One of the core survival strategies

⁶⁴ See (Gruber, Ritchey, Wang, Doss, & Ranganath, 2016)

of humans is to cooperate with other humans to work towards complex goals. Along with our ability to plan over vast stretches of time and our extensive tool use, social cooperation is one of the core strategies that humans have been designed by evolution to use for survival.

For our ancient ancestors living in pre-agricultural societies, getting kicked out of the tribe and losing social cooperation was tantamount to a death sentence. Individuals in that situation would eventually find it impossible to find enough food and to protect themselves. As a result of this, the human brain has evolved to consider social approval and the analysis of social relationships a high priority from a survival perspective. From the brain's perspective, our access to the resources necessary for survival and access to potential mating partners depends entirely on our social status, so it spends a significant amount of time analyzing these social relationships. If you spend a week paying close attention to what your brain thinks about, you will likely find most of your time is spent thinking about other people and wondering about what they think about you.

It might not be a surprise to hear that the brain network that is in charge of this type of cognition is the default mode network. Our default mode network has specific neural circuitry that identifies "other people" as distinct from ourselves and has various neurological functions to analyze what others are thinking and try and determine what their thoughts and motivations might be⁶⁵. The default mode network also focuses much of its cognition around analyzing social rules. Our brains are very sophisticated in how they keep track of what will upset people and what the expectations are for our behavior in different contexts. We also pay a lot of attention to whether other people are following social rules and if they are being fair in their interactions with us. As is the case for self-schema, the frontal parts of the default mode network (the medial prefrontal cortex) are largely responsible for maintaining socially acceptable behavior. The importance of this brain region for maintaining social rules is illustrated in the well-known story of Phineas Gage.

Phineas Gage was a railroad construction foreman who, in 1848, survived a freak accident while working on a project constructing railroad tracks. While he was using a heavy iron tamping rod to pack explosive powder into a rock, the powder ignited prematurely. The explosion launched the three-foot-long, thirteen-pound metal rod upward like a missile. It entered through his left cheek, passed directly behind his left eye, and tore through the front of his brain before exiting out the top of his skull and

⁶⁵ See (Finlayson-Short, Davey, & Harrison, 2020)

landing several yards away. Remarkably, Gage never lost consciousness and was able to speak and walk shortly after the impact.

While Gage's overall physical recovery was surprisingly quick, his personality underwent a profound transformation⁶⁶. Before the accident, he was known as a capable, well-liked, and disciplined leader. Afterwards, however, his family and friends described him as "no longer Gage." The damage to his medial prefrontal cortex left him impulsive, irreverent, and unable to follow through on plans. His ability to care about and follow social rules was greatly diminished due to his brain injury.

Another way the default mode network participates in social cognition is during conversations with other people. As we have seen, the default mode network plays a role while making decisions and some of the quickest and most interactive decision-making it engages in is verbal conversation. Conversation between humans involves quick analyses of what we should say next and what the social implications of what we say will be.⁶⁷ In this context you can think of the default mode network as the PR firm of the brain. While engaging in conversation, we are typically simultaneously listening to what the other person says while pre-rehearsing what we want to say next and judging that potential response against how it will affect how they will judge us. Our default mode network has to weigh in frequently to quickly make many micro-decisions throughout the course of the conversation.

The Narrative Self

What was I in the past? How was I in the past? After being what, what did I become in the past? Will I exist in the future? Will I not exist in the future? What will I be in the future? How will I be in the future? – Sabbāsava Sutta - ("All the Defilements Discourse" – MN 2)

As we define it in this book, the narrative self is the real-time experience of thinking about ourselves in a narrative fashion while running simulations to predict what we think needs to happen to allow us to feel safe, secure and happy. When we say "in a narrative fashion" we are pointing to the time-traveling nature of the process. While the narrative self is running, the past,

⁶⁶ See (Damasio, Grabowski, Galaburda, & Damasio, 1994)

⁶⁷ See (Kuhlen, Bogler, Brennan, & Haynes, 2017)

present, and future can be envisioned. An influential paper in the field describes it as a “cognitive elaboration of mental events” emphasizing that it is process and not simply knowledge. In the same vein, in some papers it is referred to as “narrative self-processing”. Other papers refer to this process as the “autobiographical self”.

It is built upon the structure of continuous self’s perception of “I exist”, the identity self’s complex model of reality from a self-referential perspective and the social self’s concerns about other people. All of these capacities are largely driven by the default mode network which can be considered the seat of self-relevant processing. All these various types of self come together to run simulations about the future or reimagine that past in a self-referential manner⁶⁸. Our brain frequently needs predictions of what will happen in the future and what the feeling tone or survival implications are predicted to be if that prediction comes true and the narrative self is the tool that comes online to provide this service. One of the primary times the narrative self revs up is when simulations of the future are needed during the processing of the decision making (*samsakara*) process.

The functionality of the narrative self is made possible by the default mode network’s capacity to conceive of the passage of time and then follow a narrative sequence of events that spans it. This capacity has been well illustrated through research done by a team at Princeton University at a lab led by neuroscientist Uri Hasson⁶⁹. This study investigated how the human brain processes audio information over time. It specifically looked at how the brain stitches together fleeting moments of sound into a coherently comprehended narrative. The researchers proposed that the brain processed information in a hierarchy of time periods starting from very quick moments to longer periods consisting of minutes of duration. They called these various time periods “temporal receptive windows.” To test this, they moved away from the typical artificial sounds used in labs in audio experiments and instead used what is called a “naturalistic stimulus”. A naturalistic stimulus is something that mimics real-life engagement with reality. In this case it was an engaging audio recording of a personal story narrated by a storyteller.

The way that they designed this experiment was that they modified the storyteller’s audio narrative to create several different versions, each “scrambled” at a different level of granularity. One version was the normal, intact story. In another version they rearranged the paragraphs in

⁶⁸ See (Menon V. , 2023)

⁶⁹ See (Lerner, Honey, Silbert, & Hasson, 2011)

different orders to mess up the narrative. Another version had the individual sentences in the paragraphs rearranged to further confuse the narrative. The final version had the audio chopped up and randomly reordered at the level of individual words. Participants listened to these different versions while their brain activity was scanned using fMRI scanning to determine which brain regions lit up during the different types of scrambled audio.

Using this approach, they were able to conclude that the brain is organized into a hierarchy based on time. Early sensory areas of the brain (like the primary auditory cortex) lit up even when the story was scrambled into random words. Those areas only care about immediate, split-second sounds. However, as the researchers looked further up the brain's processing chain, they found areas that stopped working unless they heard full, coherent sentences. Finally, the highest-level areas (notably the default mode network) only synchronized when the listeners heard the intact, unscrambled story. This proves the brain has internal physical correlates of time-scale processing: lower areas process the "now," while the highest levels, like the default mode network, comprehend information at temporal windows of minutes or longer.

For the purposes of dynamics that we will explore later in this book, it is important to emphasize that the narrative self is a process that is not always up and running. Its processes are spun up when simulations of the future or recreations of the past are needed. If it is not needed, it is not running.

Unified Self Perception

As we go about our lives, we have a background implicit feeling of being a "self". It is so ubiquitous that many people do not even think about the fact that they see themselves as a "self". And when we do notice it explicitly, it very much feels like a unified cohesive experience. We have seen however that being a self is actually many different threads of cognition types that process reality simultaneously. Since they are all happening at the same time it comes across experientially as one unified experience of "I".

It is also important to notice that the elements of "self" that we have explored in this chapter are not entities that we perceive, they are processes of perception and experiences that result from perception. "Self" is not a "thing" that we perceive, it is a verb that happens. The different

dimensions of self are at work when we are faced with problems to solve: The essential self is the raw experience of awareness. The embodied self is the experiential perception of body ownership. The perspectival self is the perception of existing within a scene. The volitional self is the sense that we are the authors of our own actions. The continuous self is the perception of having existed, existing and the assumption we will continue to exist. The identity self is a collection of beliefs about yourself. The social self is the experience of judging other people and determining how they judge us. The narrative self is a feeling that our life is a story. All combined together the sense of a unified self is a process that is either a perception or an activity, not some “thing” that is being perceived.

What binds all of these discrete self-perception processes together is an area in the back of the default mode network. This area is called the posterior cingulate cortex, and it is a convergence point for the various dimensions of self-processing. One study⁷⁰ looked at exactly this. The study tested whether different parts of the default mode network specialize in different kinds of internally oriented thought. Twenty-seven healthy adults underwent functional magnetic resonance imaging while performing six types of tasks involving understanding other people’s beliefs, making moral judgments, recalling autobiographical memories, imagining spatial locations, judging personality traits about themselves versus another person, and simply resting. The researchers found that these activities recruited many of the same default mode network regions, but there was also meaningful specialization. What was most notable about this study for our need was that the authors determined that all these self-referential activities converged in posterior cingulate cortex. The one type of activity that showed up most weakly in this region was when the determining whether a specific trait was best assigned to oneself or another person but even with this task that included thinking of other people, there was still some posterior cingulate cortex convergence. To keep you from having to memorize too much anatomy, we will refer to this as the “back section of the default mode network” or something to that effect when it needs to be referenced in other parts of the book.

⁷⁰ See (Wen, Mitchell, & Duncan, 2020)

The Predicting Self

In the first chapter of this book, we described the brain as a “prediction machine”. All the different levels of self that exist in this chapter all have their own jobs when it comes to predicting the future. The brain does its best to construct a multi-modal predictive model of the universe in order to know how it should act in order to maintain survival.

9 - DUALISTIC CONCEPTUALIZATION (PRAPANCA)

While investigating and understanding the implications of conceptualization is an important component of all paths of Buddhism that focus on in-this-lifetime liberation, Zen Buddhism arguably puts more direct and explicit emphasis on this goal than any other school. Many of Zen's techniques and teaching methodologies revolve around a direct inquiry into the nature and functioning of dualistic conceptualization. Given the centrality that Zen places on this topic, I wanted to dedicate a chapter to understanding what conceptualization is and what role it plays in human perception and cognition.

We saw in the Decision Making (Samskara) and Self (Atman) chapters that one of the primary inputs into human decision making are the predictive self-referential models of reality that we all hold. In this chapter we will explore the conceptual thoughts that are driven by these self-referential models. As part of this exploration, we will look at two related terms and these are *prapanca* (dualistic conceptualization) and *prapañca-saṃjñā-saṃkhyā* (dualistic conceptualizations). To give a quick preview of what these terms mean, consider the scenario where you have applied and interviewed for a coveted job you are eager to obtain but receive notice that you have not been selected and will not be hired. As your mind recognizes what has happened and begins to process the implications, *prapanca* (dualistic conceptualization) would be the real-time activity and process of the mind analyzing the situation from a dualistic perspective. The *prapañca-saṃjñā-saṃkhyā* (dualistic conceptualizations) that emerge might be thoughts such as "I am such a loser", "life is not fair" or "how could they not see how awesome I am?"

Dualistic Conceptualization - Prapanca

Prapanca when translated directly means something like “expansion”, “elaborate” or “diffusion”. It points to the idea of one elaborating or expanding a self-related story over the raw experience of reality. The self-related context of *prapanca* is illustrated in this excerpt from the *Tuvaṭṭaka Sutta* (“Quickly Discourse” - Sn 4.14):

“The root of all reckoning born of prapanca – ‘I am’”

This quote illustrates that *prapanca* fundamentally involves self-referential mental activity. Self-oriented mental activity defines *prapanca* as being inherently dualistic based on the premise that anything that involves a “self” implicitly includes the dichotomy of an “other” as well. As a result, I think it is helpful to include “dualistic” in a translation of the term.

Next, let’s look at an excerpt from the *Madhupiṇḍika Sutta* (“Honeycake Discourse” - MN 18) which is arguably the most important Early Buddhist sutta when it comes to defining and understanding *prapanca*. A key passage is:

*Eye consciousness arises dependent on the eye and sights.
The meeting of the three is contact. Contact is a requirement for feeling. What you feel, you perceive. What you perceive, you think about. What you think about, you spread-out/proliferate (papañceti).*

This sutta shows us that interaction with an object can produce good or bad feeling-tones and in turn lead to analytical thinking which itself leads to *prapanca*. In other words, when we experience rewarding or punishing sensory feelings, our mind is apt to judge and engage in discriminative analysis of the situation. That thinking then leads to self-focused mental activity. In that excerpt I momentarily choose “spread-out/proliferate” to translate the term *papañceti* (which is the verb form of *prapanca* in Pali) to reflect the most linguistically precise meaning, but given the context of *prapanca* flowing from thinking, I think the term “conceptualization” probably best captures the heart of the meaning. Using “conceptualization” maps well to later Zen writings where conceptualization is a key point of discussion and analysis. Substituting “conceptualize” for “spread-out/proliferate” the excerpt now reads:

*Eye consciousness arises dependent on the eye and sights.
The meeting of the three is contact. Contact is a requirement for feeling. What you feel, you perceive. What you perceive, you think about. What you think about, you conceptualize (papañceti).*

Putting the dualistic and conceptual contexts of the term together I feel like “dualistic conceptualization” or “dualistically conceptualizing” are the terms that best represent the cognitive activity that *prapanca* represents. Now with this full translation, the quote would be:

*Eye consciousness arises dependent on the eye and sights.
The meeting of the three is contact. Contact is a requirement for feeling. What you feel, you perceive. What you perceive, you think about. What you think about, you dualistically conceptualize (papañceti).*

Dualistic Conceptualizations - Prapañca-Saṃjñā-Saṃkhyā

If *prapanca* is the activity of engaging in dualistic conceptualization, the results of this mental activity are dualistic conceptualizations (*Prapañca-Saṃjñā-Saṃkhyā*) themselves. A literal translation of *prapañca-saṃjñā-saṃkhyā* is something like “proliferated recognized categorizations”. That is kind of an awkward phrase, so I think “dualistic conceptualizations” fits in well given that we are translating *prapanca* itself as “dualistic conceptualization”.

To get a sense of how dualistic conceptualizations relate to dualistic conceptualization, here is a larger excerpt from the passage from the *Madhupīṇḍika Sutta* (Honeycake Discourse) with our new translation included:

*Eye consciousness arises dependent on the eye and sights.
The meeting of the three is contact. Contact is a requirement for feeling. What you feel, you perceive. What you perceive, you think about. What you think about, you dualistically conceptualize [prapanca]. What you proliferate is the source from which dualistic conceptualizations [papañca-saññā-saṅkhā] beset a person. This occurs with respect to sights known by the eye in the past, future, and present.*

Here we see that there is a sequence of contact->perception->thinking-dualistic conceptualization->dualistic conceptualizations. The passage then says these conceptualizations “beset” a person which is certainly something most of us can probably relate to. The imagery is one of being overwhelmed and not in control. The section ends with the phrase “This occurs with respect to sights known by the eye in the past, future, and present” which points to the underlying mental time-travel that underpins the real-time activity of self-referential cognition. Remember that a sense of the passing of time is what creates the bedrock sense that “I exist”.

To get a sense of what individual dualistic conceptualizations emerging from *prapanca* might be like, let’s look at a Mahayana text called the *Prasannapada* which is a commentary by a 7th Century sage named *Chandrakirti* where it says this about *prapanca*:

Dualistic discriminations (vikalpa) arise from the varied dualistic conceptualizations (vicitra prapañca) — made habitual through beginningless saṃsāra. Some examples of dualistic conceptualizations are knower and known , signified and signifier , agent, object, instrument, and action ; pot, cloth, diadem, chariot; form and feeling; woman and man; gain and loss , pleasure and pain , fame and ill-repute , blame and praise, and so on.

Looking at this list with an understanding of how Mahayana categorizes conceptualization, we can see that it is broken up into different categories:

- **Subject/object** - knower and known, signifier and signified
- **Language Grammar** - agent, object, instrument, action
- **Physical Objects** - pot, cloth, diadem, chariot.
- **Dualistic Pairs** - man and woman, gain/loss, pleasure/pain, fame/ill-repute, blame/praise

As we go through life, our minds dualistically divide up the world into objects, ideas, situations and scenarios and then generate self-referential judgements about them. For example, let’s say you go on a date with someone. From your perspective the date went well, and you are excited to spend some more time in the future. The next day after the date you text them and after a few hours you notice they do not respond. That raises a bit of concern, but you remind yourself not to be too impatient. It is now the next morning and to your dismay they have not responded yet. You may very well likely become beset with dualistic conceptualizations like, “that person is so shallow”, “no one likes me”, “people find me unattractive”, “I am

going to die alone” and “life is not fair”. When faced with disappointed expectations, our minds tend to spawn all sorts of negative beliefs about the situation.

Dualistic Conceptualizations and Feeling Tones

Feeling tones (vedana) can play an important role in the manifestation of dualistic conceptualizations. Let’s revisit the excerpt in the Madhupiṇḍika Sutta (“Honeycake Discourse” - MN 18):

Eye consciousness arises dependent on the eye and sights. The meeting of the three is contact. Contact is a requirement for feeling. What you feel, you perceive. What you perceive, you think about. What you think about, you dualistically conceptualize [prapanca]. What you proliferate is the source from which dualistic conceptualizations [paṇḍita-saññā-saṅkhā] beset a person. This occurs with respect to sights known by the eye in the past, future, and present.

An interesting thing to note here is that the event that triggers dualistic conceptualization is a feeling-tone born of contact between the senses and external reality. This points to the idea that dualistic conceptualizing often revolves around beliefs about how specific objects and scenarios will possibly make us feel if they are interacted with. Feeling tones can influence dualistic conceptualizations in real-time or past learned associations between object/scenarios and valence can be part of the process as well. The mechanism is illustrated in an excerpt from Salla Sutta (“The Arrow Discourse”- SN 36.6):

“Touched by a pleasant feeling-tone (vedanā), he relishes it, welcomes it, remains holding to it — and in him the underlying tendency to lust (rāgānusaya) adheres. Touched by a painful feeling, he sorrows, grieves, laments, beats his breast, falls into confusion — and in him the underlying tendency to aversion (paṭighānusaya) adheres.”

The tendency to lust (rāgānusaya) is like a seed planted that affects future experience. It is a learned association.

To look a bit “under the hood” of the process of how learned feeling-tones affect perception, we can see how the brain processed this. When we perceive or imagine a specific object or scenario, the default mode network, which creates the narratives what we think about different objects and scenarios, can automatically predict a “feeling tone” analysis onto the dualistic conceptualizations that emerge⁷¹. It is a contextual prediction of future reward or punishment potential of what we are perceiving or imagining based on what we know about it and what the current situation is. For example, my wife and I could look at the same double chocolate cake and come to very different reactions about it. In her head, it might be “I love chocolate cake, but I am on a diet so if I eat it I would feel bad” whereas I might have the reaction, “I don’t love chocolate cake, but I am very hungry, so it sounds good.” Another example of dualistic conceptualization is that I may look at a pair of leather gloves and remember how a beloved family member used to have a pair just like them. Since I have a warm memory of those types of gloves and there is a personal narrative revolving around them, they will have a higher subjective value to me.

Dualistic conceptualizations can also be a general belief about the survival implications of objects and scenarios. For example, you may view the congregation of a group of drunken young men as inherently dangerous. Or if you have repeatedly fallen off ladders, you can develop a dualistic conceptualization that “ladders are dangerous”. You would associate negative feelings towards ladders in that case. Since having a good job is conducive to survival, you may develop a dualistic conceptualization that “getting a good college education is important” and have a positive association with the abstract concept of “college education”. Or conversely maybe your observations of the world around you might lead you to conclude, “college isn’t worth it, I need to find a good apprentice in the trades” and have positive feelings towards “working in the trades”. In both cases, the underlying association of the ability to earn a living with being able to maintain ongoing survival leads to the formation of a belief of the self-relevancy of these abstract concepts.

Survival Drives as A Source of Dualistic Conceptualizations

We have seen how dualistic conceptualizations can be established through feeling-tones but there are also scenarios where they can be triggered

⁷¹ See (Barrett & Bar, 2009)

through craving. There are three types of craving in Buddhism: cravings for pleasure, cravings to exist and cravings to not exist. To look at an example of "craving to exist", imagine you have a potentially dangerous medical procedure coming up in a month. Your mind's attention is likely to get hijacked in a way that leads to "cravings" that you will survive the encounter. The worrying about this scenario will likely be driven by all sorts of conceptual dualistic beliefs and assumptions about the procedure and medical issues in general. The idea that dualistic conceptualization can spring forth from self-referential craving is supported by a scripture called the *Mahānid-desa* ("Great Exposition" - Mnd 14):

"The root of the dualistic conceptual categorizations,' said the Blessed One, 'the "I am" ...' The dualistic conceptual categorizations are just dualistic conceptualization itself. There is craving dualistic conceptual categorizations and view dualistic conceptual categorizations. What is the root of craving dualistic conceptualization? Ignorance is a root, unwise attention is a root, the conceit 'I am' is a root, lack of moral shame is a root, lack of moral dread is a root, restlessness is a root — this is the root of craving dualistic conceptualization"

It is not hard to see how our deep-seated drive to exist would be a trigger for all sorts of self-focused beliefs about the nature of the world from the context of what will keep us alive and allow us to stay safe and secure. There is an interesting experiment that shows how these dualistic conceptualizations can be formed based on the perception of survival implications that is described in a scientific paper entitled, "Survival processing enhances retention"⁷². This paper describes how in this experiment, the researchers set out to challenge the traditional understanding of human memory, which was that "deep processing" or thinking hard about the meaning of information, was the most effective way that beliefs are formed in memory. They proposed an evolutionary alternative: that human memory systems were not designed to simply record facts but were specifically engineered by natural selection to solve problems related to survival. Their hypothesis was that if the brain is "tuned" for survival, then processing information in the context of staying alive should lead to better retention than any other method of learning.

⁷² (Nairne, Thompson, & Pandeirada, 2007)

To test this, the researchers designed an experiment where participants were asked to rate a list of random, unrelated nouns (such as "stone," "shoe," or "apple"). The participants were divided into groups and given different scenarios to guide their thinking. The "Survival" group was told to imagine they were stranded in the grasslands of a foreign land without supplies and needed to rate how relevant each object was to their survival. To ensure the results weren't just because the task was engaging, they compared this against a "Moving" group, who imagined they were moving to a new apartment, and a "Pleasantness" group, who simply rated how nice the words were. After the rating task was finished, the researchers surprised the participants with a memory test to see how many words they could recall.

The results provided strong evidence for the evolutionary hypothesis. Participants who had evaluated the words through the lens of the "survival scenario" remembered significantly more items than those in the "moving" or "pleasantness" groups. The study concluded that our predictive memories are not neutral recorders of the world; rather, they are biased to prioritize and lock in information that our ancestors would have needed to stay alive. It shows why these types of predictive dualistic conceptual beliefs are formed. We are more likely to remember something if it will help us predict what will help us survive.

Dualistic Conceptualizations and Predictions of Valuation

We saw earlier in the *Madhupiṇḍika Sutta* (Honeycake Discourse) that an experience of pain or pleasure from a feeling-tone could set off sequence of cognition that led to dualistic conceptualizations. Another sutta called the *Sakkapañha Sutta* ("Sakka's Questions" – DN 21) shows how it can flow the other way as well. The relevant excerpt is:

"But good fellow, what is the source, origin, birthplace, and inception of jealousy and stinginess? When what exists is there jealousy and stinginess? When what doesn't exist is there no jealousy and stinginess?"

"The liked and the disliked, lord of gods, are the source of jealousy and stinginess. When the liked and the disliked exist there is jealousy and stinginess. When the liked and the disliked don't exist there is no jealousy and stinginess."

"But good fellow, what is the source of what is liked and disliked?"

"Desire is the source of what is liked and disliked."

"But what is the source of desire?"

"Thought is the source of desire."

"But what is the source of thought?"

"Judgments driven by the proliferation of perceptions are the source of thoughts."

While the *Madhupīṇḍika Sutta* (Honeycake Discourse) has the sequence flow from feeling to dualistic conceptualizations, the *Sakkapañña Sutta* (Sakka's Questions) runs the other direction starting from dualistic conceptualizations through feeling-tones to jealousy and stinginess. This shows how our past experiences (driven by feeling-tone interaction) can create beliefs and assumptions about the world which lead to thinking that in turn leads to thought, desire and emotion-driven behavior.

Whether a dualistic conceptualization is based on feeling tones or a belief about how to best survive, they are very important as filters and inputs during the five aggregate decision-making process. The importance of dualistic conceptualization involving feeling tones in decision making is illustrated in the case of a subject named Elliot who was described in the book *Descartes' error: Emotion, reason, and the human brain* written by the neuroscientist Antonio Damasio. In this book, Damasio explains the plight of the patient named Elliot who needed to have a brain tumor surgically removed and as a result much of this orbitofrontal cortex was damaged. We defined the orbitofrontal cortex earlier as a database in the brain that the default mode network and central executive network use when calculating the final subjective value of an option when making a decision. It is a dynamic database of objects/phenomena and an associated mapping to a predicted feeling tone result of interacting with a particular object/phenomenon.

Since only Elliot's orbitofrontal cortex was damaged, his other cognitive processes were fully intact. Elliot's memory was undamaged and he knew who people were, what different items were, how those items functioned and could understand and focus on task instructions. His problem lay in that he had "flat affect". The damage to his orbitofrontal cortex left him with an inability to associate potential pleasant or unpleasant feeling-tones with particular items or scenarios. For example, when he was presented with a picture of a severed limb or a beautiful landscape, his body would not react. He could not assign a "good" or "bad" tag to any object or choice.

As a result, Elliot could spend 30 minutes deciding which color pen to use to write a note. To him, the blue pen and the black pen have equal

"weight" because his ability to determine subjective value was silent. Using logic alone could not break a tie for him when trying to decide between options. Elliot lacked the ability to engage in full dualistic conceptualization (*prapanca*). This case shows the importance of being able to judge the potential subjective value of what we interact with in this world. Without it, normal functioning is not possible.

Modes of Using Dualistic Conceptualizations

As we engage with life on a day-to-day basis, there are two main modes in which the default mode network's capacity to engage in dualistic conceptualization is called upon to provide its services. The first mode is "task mode". This mode happens when the brain is called upon to do a task based on some need to interact with the world. In this mode, the brain usually asks the default mode network to determine the subjective value of an object or scenario that is being evaluated. The default mode network can view an object or scenario through the schema-tinted lens of dualistic conceptualization. The end result of this evaluation is a determination of how much value something has in relation to the "story" of someone's life. In this mode, the brain is usually asking questions like "should I get that?" or "which of these should I choose?" or "should I avoid that?" or "Should I be angry about this?" or "Should I be sad about this?" To answer these questions, the brain needs to know what the target scenario or object means to them. When the brain needs a quick "gut reaction" about whether an object will make us feel good or whether a scenario is conducive to survival, the identity and social selves can be treated almost like databases to look things up in. But when the brain needs a simulation of a future possible scenario to help make a decision or determine what is important, the full narrative self will come online to help predict the future.

The other mode could be called the "mind wandering mode". In this mode, our attention isn't being targeted towards a task to complete or decisions to make, but rather attention is out of our control, and the narrative self wanders off of its own accord. This mind wandering can be relatively benign daydreaming or non-directed problem solving or it can be aversive as are the cases of ruminating or worrying. In either benign or aversive mind wandering, the default mode network is dominating attention with its mental time travel. It is either reliving the past through memories or simulating the future over an extended period of time instead of the brief bursts of mental time travel that are found in task-mode narrative self activity.

10 - OWN-BEING (SVABHAVA)

If you can think of dualistic conceptualizations as sentences that describe our self-referential opinions and predictions of reality, the target of these thoughts will often be objects that can be identified and recognized as individual entities. Our minds create all sorts of conceived mental representations around objects like “that car”, “this democracy”, “that monster” and “that insult”. The sense that a conceived and mentally represented object has its own being or individual nature of its own is called *svabhava* in Buddhism. *Svabhava* can be translated as “own-being”, “independent existence”, “individual existence”, “individual being” or “inherent reality”. Since “own-being” is the most common translation, we will stick with that. If perceived objects did not seem identifiably real, they would not have much weight when evaluating and discriminating during conceptualizing or decision making. As a result, we have the perceptual felt-sense that objects, phenomena and concepts in the world exist independently and objectively regardless of the subjective interpretation of us as a viewer.

As a quick aside, if you have some prior knowledge of the topic of own-being, you might be having some alarm bells going off right now. Some Mahayana philosophers like Nagarjuna go to great pains to convince their readers that everything in the universe is empty any type of own-being. This is a core teaching of Mahayana Buddhism that we will explore later but it's important to make the distinction that in this chapter we are discussing how objects appear within conventional reality; not what their nature is ultimately. From the perspective of conventional reality, things really do seem to have real individuality. My bed seems like my bed. It seems to be a separate object with an identity I can recognize. My wife seems like my wife. From my perspective, she has the perceived quality of being herself.

Abstractions can have own-being as well. Anything that can be bounded and represented in the mind can have own-nature. For example, “my anger”, “this day”, “our culture” and “this headache” can all have a sense of

individual existence. If you have a headache you can think, “this headache is worse than the one I had yesterday.” Without the ability to distinguish between the two headaches, that sentence would be nonsensical. An example of this type of abstract modeling is found in a work titled *Catuḥśataka* (*Four Hundred Verses*) by the Mahayana sage Aryadeva:

*Even an unpleasant insult does not cause hurt feelings
through its own-being.*

He goes on to argue that our own reaction to an insult is what causes suffering but the interesting thing here is the point that even something as seemingly abstract and ephemeral as an insult can be represented in our minds as an entity with its own character. Someone can think of “that insult” and compare it to “that other insult”.

The Illusion of the Own-Being of Objects and Phenomena Feels Quite Real

The ability to cognize conceptual representations of individual objects and then to think about these objects in a dualistically conceptual manner is highly dependent on the default mode network. The default mode network’s processing of reality within the five aggregates is for the purpose of making determinations in how to interact with the world in a way that is (hopefully) conducive to feeling good and surviving. The thing is, our planning and thinking is only effective if we actually believe that our internal models of reality are objectively real or at least “real enough”. When we mentally represent objects that we are perceiving or imagining, we are not really viewing the “real” object but rather our own predicted inference of what it must really be like. It is basically an illusion that our abstract mental representations have “own-being” outside our mental image of them. In Buddhism this “buying into the illusion” is called *parikalpita-svabhāva* which can be translated as “imagined own-being”. An example of this usage can be found in Vasubandhu’s “*Thirty Verses*”:

*“Whatever entity is discriminated by whatever kind of
conceptual thought, that is the imagined own-being
(parikalpita-svabhāva). It does not ultimately exist.”*

You might be asking yourself why not just view reality directly and objectively and accurately? Why go to all this trouble to create abstract best-guess predictive models of reality instead of just viewing reality directly

like a video recorder would? This is a question tackled by a neuroscientist named Donald D. Hoffman in his book, *"The Case Against Reality: Why Evolution Hid the Truth from Our Eyes"*. In this book, Hoffman makes the argument that evolution does not necessarily care whether an organism sees the world accurately; it cares whether the organism behaves in ways that help it survive and reproduce. Imagine two animals searching for food. One sees every detail of the environment exactly as it really is, including countless details regardless of whether those details have practical importance or not. The other organism sees a much simpler world in which potentially life-supporting food stands out, predators look clearly threatening, and dangerous scenarios are obvious. The first animal may possess a more truthful picture of reality, but processing all that information could take too much time and energy. The second animal may misunderstand the deeper objective truth of what it perceives yet still make faster decisions that are more conducive to its survival. Over many generations, natural selection would tend to favor the animals whose perceptions guide successful behavior, even when those perceptions simplify, abstract, or conceal objective reality.

Hoffman offers a compelling analogy where he compares perception to the icons on a computer desktop. For example, a document icon is an abstract representation of what in actual reality is an array of varied electrical charges on a storage device. If we wanted to see the contents of the file and were given the raw electrical data of the storage device it would be less than useless to us. The file icon gives a high-level abstraction that provides a much simpler and more useful way to interact with the file's information. In the same way, colors, shapes, objects, distance, and even the ordinary appearance of space and time may function like perceptual icons in our minds. They tell us what we can approach, avoid, eat, fight, or mate with without having to show us the minute details of reality. From this perspective, perception and information processing in the brain are less like a transparent window onto the world and more like a useful dashboard designed by evolution to keep us alive.

Continuous Selves and Own-Being

The great Sage Nagarjuna says:

"If there were own-being, the world would be unproduced, unceased, and unchangeable, and it would be devoid of its many different states"

Looking at it from the other direction, anything that seemingly has the momentary appearance of not being produced, not ceasing, not changing and devoid of different states would seem to have its own-being. As it turns out, this describes most of the things we perceive in our lives. The sense of ongoing continuity in a stable form allows the brain to map “beingness” to something. When combined with the cognitive capacities of trait discrimination and individualization discrimination we can even have the sense of an ongoing object having identity as an individual. This allows for the opportunity to project dualistic conceptualizations onto an object infusing it with emotionally consequential meaning and value.

Even over a period of time, a phenomenon called change blindness⁷³ can mask enough change in an object that it allows for an ongoing stable identification of an object even when it undergoes transformation. The brain still perceives it as a cohesive and ongoing entity. For example, you could change every single part of a car over time, but the mind would still see it as a particular car with a particular entity. A relationship can undergo slow but significant transformation, but the brain would smooth out the changes to maintain a cohesion of identity for that relationship. If there is too much change too fast, this can overwhelm change blindness and alter identity. For example, a dent in a door of a car can end the identity of “my new car” and spawn the identity of “my car”. Once the mind has stabilized on the ongoing state of the new conception, awareness of the birth of the new identity would likely fade away creating the illusion of stable identity over time.

Part of ascribing ongoing identity to an object requires prior memory of its existence. This is a similar cognitive dynamic as with what we observed in the Self (Atman) chapter when we were introduced to the idea of a continuous self. Our continuous sense of self is a pre-cognitive perceptual sense that we exist, and this existence has a continuity over a stream of time. It may seem like this would be something that is just inherently obvious to the brain, but it turns out that this perception is predicated on memory of having had consciousness in the past. We explored the case of Clive Wearing who had profound ongoing amnesia and was unable to form memories that lasted longer than just a few seconds. Since he could only remember for just a few seconds before memories vanished forever, he spent his remaining years feeling like he did not actually exist. Every moment felt new and without the continuity of memory of awareness he did not feel a sense of personal existence.

⁷³ See (Simons, Franconeri, & Reimer, 2000)

It turns out that this inability to perceive a sense of personal continuous self-existence also extended to objects other than himself. For example, for six and a half years, Wearing lived in the same room in a psychiatric unit at a hospital, yet he never came to recognize it as his own room⁷⁴. He retained general pre-amnesia memories of what a room was and what objects would typically be found in a room, but severe ongoing amnesia prevented repeated experiences of that room from accumulating into the personal knowledge that he lived here, that those were belongings, or that he had slept here many hundreds of times before. Each encounter with the room lacked a continuous history connecting it with any of the previous encounters. Because of a lack of history accumulating over time, that room never gained the individual existence status of “his room”. It was not a discrete entity that he could dualistically conceptualize as something unique from all other “not my” rooms. It lacked subjectively projected individual existence as “his room” from his perspective.

Another fascinating anecdote about Clive Wearing also shows how individual existence depends on a continuous sense of self. At one point Wearing’s wife found him holding a piece of chocolate motionless in his left palm while repeatedly covering and uncovering it with his right hand. She described it “as if he were a magician” performing a trick. Each time he lifted his right hand, he stared at the chocolate with surprise and told her that a new one had appeared. When his wife explained that it was the same chocolate as before, he disagreed with her and insisted it was a new one. He repeated the action every few seconds, becoming absorbed in the mystery of how a new piece of chocolate could appear each time. His memory of chocolate having existed vanished so quickly that each time he uncovered it, it was brand new to him. He could not track it as the same object over time. This illustrates the core role that memory and being able to process memories with the default mode network play in cognizing persistent identity through a perception of continuous self.

There is another angle to individual existence we can explore using Clive Wearing’s brain memory loss in a thought experiment. The angle I am referring to is the great Mahayana philosopher Nagarjuna’s argument that individual existence is incompatible with interdependence. Stated in another way that might not be immediately obvious, the illusion of individual existence is only possible if we are able to conceptualize a narrative of compounded entities being separate from each other over a timeline. Let’s take Nāgārjuna’s famous example of fire and fuel as being interdependent on

⁷⁴ See (Sacks, 2007)

each other. In *Nāgārjuna's Mūlamadhyamakakārikā* ("Fundamental Verses on the Middle Way") he states:

"If firewood were fire, actor and act would be one. If fire were other than wood, it would occur even without wood."

Now let's imagine Wearing being led to a wood fire in a fireplace near where he lived. In each snapshot of existence that he experienced, the burning fire would exist for the entirety of his perceived existence. Depending on how we wanted to frame it, you could say that the fire is timeless or eternal within his experienced reality of the world. From Wearing's perceptual perspective there has never not been this specific fire and from that perspective, that particular wood and fire are forever linked and inseparable. He would have no memory of that wood existing outside the context of that fire. From his perspective, that specific fire and that specific wood would be compounded for eternity and have no independent own being or individual existence outside of their present combined interaction. The ability to experience this fire and this wood as separately persisting individual entities requires a remembered history in which one was encountered without the other. Without time, they do not have any continuous self-nature. But for those of us that can track objects across time, we can perceive them being discrete entities as separate from their later compounded state. This is not to say that Wearing could not access semantic memory and know hypothetically that wood and fire could be separate as categories of objects; the point to understand here is that experientially and perceptually, his personal experience of this specific fire and this specific wood have never had any real-time existence where they are not linked and co-existing.

Another thought experiment shows how Wearing would likely have had a hard time tracking the continuous identity of very abstract entities and phenomena like "arguments". Let's imagine that Wearing had the impulse to get in an argument with someone. For a few seconds Wearing might begin to formulate the argument in his head and might even have some elevated fight or flight arousal in his nervous system, but it seems highly likely that the argument would be over just as it started or even before it began. Wearing would not be able to track the continuous self of "that argument". It would have no ongoing identity. The same would likely be true of an insult he received. He could perceive the insult and might get briefly upset, but the insult would not have had the capacity to create persistent distress, but it would fade from memory and cease having recognizable identity.

Wearing's tragic brain damage offers a window into how the brain projects an own-being status onto objects of perception. Wearing's ability to perceive things and situations as individual objects was, at best, severely damaged and his ability to construct the equivalent of continuous self and narrative self onto them was completely eliminated. Without being able to witness or imagine a continuous existence through time, objects cannot have a sense of having "own being" in our minds. Time is an inherent facet of own-being-ness. Dogen Zenji, the founder of Japanese Soto Zen says:

"Mountains are time. Oceans are time. If they were not time, there would be no mountains or oceans."

From the perspective of the teachings of own-being, we can interpret this as meaning that without time, our mental predictive perception of an object having individual existence would not exist.

Own-Being and Dualistic Conceptualization

Once our minds can establish the raw being-ness of a mental representation of an object by being able to conceive of it as continuous through time, this perceived own-being can be combined with other types of discrimination to perceive that an object has a sense of wholeness and that it has unique traits⁷⁵. For example, if you had three gift baskets on your desk, even though each one was a composite of multiple things, you can conceive of each one as a unified entity. You can also discriminate between them based on any unique characteristic of each one. One might be bigger than the other for example. This capacity to see object representations as unified and identifiable individual entities allows the mind to build narrative stories about our relationship to them with dualistic conceptualization. For example, you might recognize one of the gift baskets as similar to one that you received as a kid for winning a raffle at a fair. This would map a feeling onto it.

Dualistic conceptualization is truly what gives a mentally represented object the quality of having its own-being but it is important to understand that we are not talking about its *physical reality* of its existing as its own-being. The Buddhist concept of own-being is not an ontological declaration. For example, simply being able to pick out an object as an individual physical entity doesn't require you to have predictive feelings and emotionally

⁷⁵ svabhāva-vikalpa, viśeṣa-vikalpa and viśeṣa-vikalpa – See *Bodhisattva-bhūmi* by Asaṅga

salient beliefs about it. For example, if you see a mug that you have never seen before and just want to use it to get a quick drink of water, you don't need to perceive that mug's conceptual uniqueness to do so. Just knowing its "type" (*samjna*) and being able to recognize that it is physically separate from other objects (*vijnana*) is enough. At that point, your brain's muscle memory knows what to do to get the water. Own-being, in the Buddhist psychology sense, really only has emotional consequence if we have predictive conceptual beliefs about the "story" around an object; a story that predicts what the feel-tone or survival implications of an object are. Another way to say this is that own-being revolves around mental time travel. Our dualistic conceptualization about an object involves thinking about its history or imagining it in the future and our sense of identity about an object fundamentally involves our predictions about it.

As an example of what conceptual own-being in the context of time travel is, imagine that you are starting a new degree program your belief that it is worth the time and the money involves predictive simulations of the future to ascertain what the rewards may be. When you think about "that degree program" as an entity with its own being, those types of predictive beliefs are part of its identity from your subjective perspective. In the same manner, if you know your neighbor plays loud music into the night, part of his identity in your mind is that he is the type of person to do that. This is the type of identity that captures our attention.

One last thing to mention on this topic before we move on is that the predictive beliefs we have about a classification or category can influence our opinion of an individual entity. If for example you had the belief that "rich businesspeople are arrogant jerks" then you would likely apply that prediction to any particular businessperson that you met. When we are perceiving a specific individual entity, our sense of its identity will always be a mix of 1) what we are perceiving about it in real time 2) predictive beliefs we have about any classification/categories that we assign to the entity and 3) memory-based predictive beliefs we have about that particular entity.

11 - ATTENTION (MANASIKARA)

There is a famous story involving a Zen master from medieval Japan named Ikkyu. He was asked by one of his lay patrons to create a calligraphy scroll that represented the deepest teachings of Zen. In response, Ikkyu wrote the single word, “attention”. Somewhat perplexed, the layman asked Ikkyu if he could elaborate on it with something a bit more profound. Ikkyu then wrote, “Attention, Attention.” Feeling a bit frustrated at this point, the layman told Ikkyu that he didn’t see much depth of wisdom in what he was writing. Ikkyu then wrote “Attention, Attention, Attention”. Completely bewildered at this point, the layman asked, “what does attention mean anyway?”. Ikkyu responded, “attention means attention.”

This may sound like an exaggerated statement, but I would contend that a lack of control over attention is the core source of human trouble and suffering in our lives. Over the course of this book, I hope to show direct control over attention is the key mechanism in Zen training and that ultimately indirect and organic control over attention drives the deepest fruition that comes from this practice. To set the stage for these explorations, I would like to first take a look at what attention actually is and how it works.

The Buddhist Definition of Attention

Manasikara is the Buddhist term that is most often translated as “attention”. Looking at *manasikara* from an etymological perspective, “*manasi*” means “in the mind” and “*kara*” means “doing”. Putting these together *manasikara* means something like “doing something in the mind”. It is the focus of the mind on some object or phenomenon. From the Buddhist psychological perspective, there is helpful attention and unhelpful attention. We will wait to tackle these two categories in a later chapter, but to help illustrate the crucially important place that attention holds in Buddhist practice, let’s take a

look at a scripture called the *Paṭhamasekha Sutta* (“A Trainee Discourse” - Iti 16) where the Buddha posits that:

“I do not perceive any other single factor that is so helpful to a practitioner, who has not yet attained the goal but dwells aspiring for the unsurpassed security from bondage, as this: skillful attention”

What Do Scientists Mean by Attention?

Having seen the crucial importance that attention plays in Zen Buddhist practice, let’s turn and look at what science can tell us about attention. Stated simply, attention is what we are consciously aware of in the current present moment. If we notice something consciously, it is in our attention. Attention is like a spotlight in the sense that it has focus. We can move our attention around (or it can be moved around for us) which allows us to focus on different aspects of experience. We can be aware of external events, internal feelings and the content of our thoughts and imagination. Our brains can subconsciously be aware of things, but for it to be considered “attention” it has to be the content of conscious awareness.

The Neuro Correlates of Attention

For the purposes of our discussion in this chapter, the human brain can be physically divided up into three parts: the cerebral cortex, the subcortical brain, and the brainstem. The cortex is where we find most “higher order” cognitive functions. It is the outer shell of the brain and as we move from the rear sections to the front you will find sections in charge of vision, spatial/body awareness, hearing, language, object-recognition, physical movement, executive functioning, abstract thought and self-referential processing. The subcortex is a collection of deep brain structures that coordinate emotion, memory, motivation, attention, and the flow of information, helping the brain decide what to notice, remember, feel, and do. The brainstem works by regulating essential life supporting functions such as breathing, heart rate, sleep, and alertness while serving as the main communication pathway between the brain and the rest of the body.

The most relevant part of the subcortex when we are discussing attention is the thalamus. It acts as a central hub that routes sensory information and signals throughout the brain. It connects with various cortical regions

in “loops” that send information back and forth between the cortex and itself⁷⁶. Some of these cortico-thalamic loops support brain functions that are not brought into awareness but a number of them are. Current research points to the idea that any consciously aware and attended to experience we have is because a brain region is sharing information with the thalamus in a looping manner. If a brain region is not looped in with the thalamus, then its information is not available to attentional conscious awareness. I like to call the cortical brain regions that coordinate with the thalamus to bring information into awareness “attentional content generators”.

If all of the regions that loop with the thalamus had similar “volume” it would be overwhelming and impossible to be aware of any one particular thing. For this reason, the brain has mechanisms to emphasize and strengthen particular thalamic loops so that awareness can best focus on whatever is most important at any given time. One mechanism in which the brain highlights particular loops is implemented in a “top-down” manner through the cooperation of various brain region networks located in the pre-frontal cortex in the cerebral cortex⁷⁷. As the name implies, the prefrontal cortex is in the front area of the cortex, and it is in charge of planning, reasoning, goal maintenance, emotional control and purposeful attention targeting. Another mechanism in which attention is controlled is considered “bottom up” and this is implemented through thalamic interactions with both cortical and subcortical regions that can act as alarm systems. The alarm systems can be tied to emotions, threats and visual reflexes and will generally take quick control of attention when something important and/or surprising happens.

A last type of control mechanism we will consider are what scientists sometimes call “internally generated thinking”. Generally, “top-down” and “bottom-up” attentional mechanisms are working in response to events or tasks that involve things happening to or outside of the body. Internally generated thinking is most active when we are resting or when a current task does not require much top-down attention. In these moments, the brain can take advantage of these downtimes to think about the past and run simulations of the future. This can take the form of planning, daydreaming, ruminating or worry. The brain network in charge of this type of thinking is one we have encountered a few times already: the default mode network.

⁷⁶ See (Saalmann, Pinsk, Wang, Li, & Kastner, 2012)

⁷⁷ See (Miller & Cohen, 2001)

Attentional Content Generators

The following are the primary brain networks that can produce the “content” through cortico-thalamic loops that can potentially show up in current-moment attentional awareness when they are selected to be highlighted:

- **The Somatosensory-Motor Network** – This network provides the raw, embodied feedback of physical existence, including touch, vibration, and proprioception (limb position). It fills awareness with the immediate reality of where your body boundaries end and the world begins. Without this network's content, the observer would feel like a disembodied viewpoint floating in space. This network participates in *rupa* and the perception of a perspectival and embodied selves.
- **Visual Network** - It supplies the imagery that populates your field of view, including color, shape, contrast, and motion. The visual network creates the "picture" that you actually see. This content flows from the retina through the thalamus to the visual cortex to create a coherent image.
- **The Auditory Network** – This network handles the raw experience of sound, distinct from understanding the meaning of words. It processes the “soundtrack” of the present moment, including the pitch, tone, and volume of the world around you.
- **Limbic Network** – This network assigns emotional value to both external sensory objects and internally generated thoughts and simulations. It determines whether a specific memory, future plan, or thought is perceived as threatening, rewarding, or meaningful. This network injects the "feeling" component into abstract cognition.
- **Language Network** - The Language Network is responsible for both the production of internal verbal thought and the comprehension of external speech and text. It decodes incoming auditory or visual signals to extract semantic meaning, allowing the observer to understand language generated by other people. Simultaneously, it organizes abstract concepts into grammatical syntax for your own internal monologue or spoken output.
- **Default Mode Network** – As we have seen, this network is focused on time-traveling and self-referential thinking and in

producing simulations of the future. It processes awareness of other people as conscious individuals and makes educated guesses on what their internal thoughts might be. It engages in complex modeling of reality from a self-referential perspective and is a core player in determining the potential future reward of options during decision making.

- **The Central Executive Network** – This network is in charge of active problem-solving, logic, and rule maintenance. It participates as the "voice of reason" during decision making. It is in charge of "working memory" and the conscious effort to hold the steps of an active plan in mind.

Top-Down Attention

The dorsal attention network is the brain's "present moment awareness" network. It is highly involved in targeting external objects. It is the neurological basis for voluntary focus and orientation toward the external world. The central executive network, which is charge of planning and plan implementation and the dorsal attention network work together to create what is we have defined earlier as "top-down awareness". This is when we decide explicitly about what we want to focus on.

For example, in our unseasonable apple scenario where we decide to investigate the apple, once we have made that decision, our attention is going to be focused on that apple and how to access it. This is an explicit top-down control of our attentional awareness. It is a volitional and purposeful act of moving the spotlight of our awareness.

Bottom-Up Attention

When something important (or at least potentially important) is happening outside or to your body, the attentional system will typically interrupt whatever task or daydreaming you are involved with and highlight a new loop with the thalamus related to the relevant new issue that needs attending to. There are two brain networks that are involved with this⁷⁸. The first is the ventral attention network which acts as a "circuit breaker" for attention, specifically designed to detect unexpected events or stimuli beyond what you are currently focusing on. This network scans the senses for novel

⁷⁸ See (Menon & Uddin, 2010) and (Corbetta & Shulman, 2002)

events and alerts the brain when something important happens. While the dorsal attention network is in charge of top-down attention, the ventral attention network is in charge of bottom-up attention.

The second network that is involved with bottom-up attentional processing is one that has been named the salience network. While the ventral attention network asks, "Is it unexpected?" the salience network asks, "is it important?" One common way the salience network will be invoked is by the faster-acting ventral attention network. Something unexpected can happen and the ventral attention network will highlight the thalamic loops relevant to the event and then the salience network will take over to evaluate the importance of the situation. If it's not that important and salient the salience network will switch attention back to mental time travel or task orientation, but if it is important, it will wake up the central executive network which will then wake up the dorsal attention network to start focusing our attention on different things based on how the analysis of the situation is going.

Other ways the salience network can be alerted to determine the importance of something are body feelings, remembered tasks, emotional states or episodic memories. All of these can trigger the salience network to evaluate the salience of what is happening and then trigger the executive network if needed.

To make all of this concrete, let's consider that while walking over to investigate our unseasonable apple, we hear the sound of an angry dog barking behind us; our attention on the apple and how to get to it will likely be disrupted. Our brain will move its attentional spotlight to now focus on the source of the barking. The ventral attentional network will first orient our attention towards this new situation and then invoke the salience network to consider the importance of what is happening. Likewise, if we are walking over to the unseasonable apple and all of a sudden, we feel a sharp pain in our leg, this could also involve our salience network to determine if it has to grab our attention away from what we were focusing on. The dog bark and the leg pain examples are potentially unpleasant perceptions, but pleasant perceptions can grab our attention as well. For example, if we see a beautiful flower, that too can grab our attention.

Present Moment Attentional Mode vs Narrative Self Attentional Mode

As the salience network evaluates real time events, memories or thoughts and switches brain networks on and off, attention is being activated by the appropriate cortico-thalamic loops to the networks that are “content generators”. If its loop is being highlighted, it can produce content that can show up in attentional awareness on and off.

For our purposes there is one type of large-scale brain network switching that is particularly important and this involves two different attentional modes. We can call the first mode “present moment mode” and it is largely focused on what is happening “right now” with a special focus on the sensory content of the present moment. The other mode is what can be called the “narrative self” mode. In this mode the brain is more disengaged with the sensory reality of the present moment and is running self-referential narrative simulations of the past, present or future. This is the real time activity of the “narrative self” that we explored in the Self (Atman) chapter. This present moment mode can be turned on by the salience network when something unexpected is happening in our environment or within ourselves or it can be explicitly invoked through thinking. Either way it is a top-down type of attention. In this mode we are firmly rooted in the reality of the present moment. Habits are diminished and we are primed for volitional and reactive action. One of the key players in the present moment mode is the dorsal attention network which often participates in top-down directed attention. Other participating networks might be the central executive network and the salience network itself.

The narrative self mode can be activated by the salience network when nothing is particularly pressing in the present moment, and the mind has the luxury of mental time travel and relative sensory disengagement. When the mind is in this mode, the brain can spend its time daydreaming, planning, ruminating or worrying. This type of mental activity is often called internally directed thought and is produced by the default mode network. In contrast to the present moment mode, this mode is based around mental time travel and self-referential thinking. In this mode, the default mode network constantly accesses memory about the past or is running simulations about the future in relation to what is deemed important to self-referential needs. Often the goal of the narrative self mode’s simulations is to predict the feeling-tone or survival implications of different possible scenarios.

The salience network often has to switch between these two modes⁷⁹. Scientific literature used to refer to the underlying networks of these modes as the “task positive network” and the “task negative network”. It turns out the default mode network has a lot more utility than just running when there are no presently active tasks, so these terms have been largely deprecated, but when looked at from the perspective of attentional modes, they are still pretty descriptive of what actually happens in the brain. By this I mean that these modes are differentially activated and don’t run at the same time. If we are focused on the present moment, the salience network will usually silence the default mode network’s daydreaming, planning, ruminating or worrying so that we can stay focused on what is presently important. Conversely, if there is nothing currently pressing in the present moment, it makes sense to invoke the narrative self mode so that this downtime is not wasted. If the salience network feels that this would be a good time to turn on the default mode network and plan for the future, it would be highly distracting if our attention was being bombarded with everything that is perceivable in the present moment. As a result, these two modes are largely anticorrelated⁸⁰.

To understand why evolution has designed us this way, it is helpful to consider what life would be like in the world we, as a species, were designed to live in: the plains of Africa. Imagine you are a tribal member in the days of early anatomically modern humans, and you are walking by yourself between two villages. You walk along through bushes and tall grasses and since the way is well known and you are feeling relaxed, your salience network notices that it would be a good use of this downtime to engage in some time-traveling and self-referential based thinking. Why waste this valuable downtime doing nothing? You switch into narrative self mode, and you start thinking about how the chief was curt and unfriendly with you this morning. You start running through the events of the morning to try and ascertain if you inadvertently did something to insult or anger him.

When you are engaged in this type of thinking, there is no need to be hyper aware of what is happening outside of or to the body. That would waste valuable calories, and it would distract you from the focus you need to effectively ruminate and solve this perceived problem. To achieve this internal focus, the salience network turns down the volume on brain areas that process present moment sensory awareness. This allows you to focus

⁷⁹ See (Dixon, et al., 2017). To be precise the primary anti-correlation is between the “core subsystem” of the DMN and the DAN. The core subsystem are the nodes the DMN that are most self-referential in activity.

⁸⁰ See (Devaney, et al., 2021)

on your problem involving the chief without being distracted by the mundane and predictable scene you are walking through but all of a sudden, you reach an area where there have been occasional animal attacks over the years. Not enough to be highly worried, but often enough that it makes sense to pay attention to what is going on. You maintain an open awareness so you can stay vigilant to whatever might happen. You are not concentrated on any one thing rather you maintain a state of watchful awareness. When you switch into this vigilant mode, it makes sense to turn down the volume of the default mode network. Its chatter and simulations will too easily distract you from your open monitoring of your current situation. Sensory engagement is prioritized.

Another scenario to imagine is one where you are sitting by a river and have a spear in hand and are waiting for a big fish to swim by that you can catch by spearing it. You know from past experience that once you see a fish, you have to keep a close eye on it so you can track its location in order to know when it gets close enough to catch. You also know from past experience that if you are not focused, you will not be attentive enough to stay focused on the fish. In fact, the last time you were here you were lost in daydreams about the attractive person you saw in a few villages over during a trading trip. Since you were not very focused, you had a hard time keeping track of all the fish that swam by and you missed every single one. To be successful, you really need to invoke focused attention.

You will notice that there were two types of attention in those two scenarios. One required an open and diffuse style of attention, and one required a narrow and focused one. It is notable that it made sense to turn down the noise and distraction of the default mode network in each case.

One thing that meditators quickly notice when taking up the practice is that “we” (our real-time volitional awareness), do not have much say about which mode is currently turned on. Often times we will try and assert top-down attention control to stay present but almost invariably the salience network will determine that there is nothing pressing happening and turn on the narrative mode against our wishes. This can happen even when we are engaged in tasks if they don’t require too much attention. It is especially apt to happen if we are very concerned about something. In these cases the resulting emotional intensity will make it virtually impossible to stay present because the salience network engages the default mode network to ruminate or worry even if there is a task we should otherwise be focused on.

Maintaining Attention

So far in this chapter we have described the mechanism of how the brain chooses what to focus on in any given moment. What we will next explore is how the brain maintains its focus on a task over a sustained period of time. Maintaining isn't like pressing a "pay attention" button that keeps attention effortlessly focused on what we want it to be aware of. This type of sustained attention requires constant maintenance because the spotlight of attention does not naturally hold still once set⁸¹. The salience network is constantly scanning the world and our own bodies for anything more important than what we are currently doing, and the default mode network is always ready to engage in daydreaming, planning, or worry if the salience network lets it. If the salience network determines an event is more important than what you are currently doing, it will involve the dorsal attention network and executive network to initiate a new task that interrupts the old one.

Because of these constant interruptions, maintaining attention on what we volitionally consider important requires constant vigilance and maintenance. When we volitionally decide that something is important and a goal is set, the executive network makes an effort to keep the task in working memory for as long as it can before a bottom-up event moves attention somewhere else. Once attention has been lost, it then becomes the salience network's job to notice when we are not attending to it and bring attention back to it. Plans/goals are one of the factors that the salience network attempts to keep track of as it is scanning for salient things that require attention. The more "fit" the executive network is, the better it is at keeping a task active in current working memory. The more "fit" the salience network is, the more likely it will be able to notice when our plans are being ignored due to other plans or default mode activity. It is absolutely possible to be better or worse at maintaining attention.

⁸¹ See (Hasenkamp, Wilson-Mendenhall, Duncan, & Barsalou, 2012)

12 - DESIRE (CHANDA)

Imagine a scenario where you have decided to buy your first house. You have saved up for years and changes in the market make it more of a buyer's market than it has been in years. You spend a couple of weeks going to open houses with varying levels of interest in the places you see, but eventually you find what seems to be a really good match. You imagine yourself living there and these simulations of the future inform the decision that it would be a good idea to purchase this place. You feel a strong push of motivation to buy this place and make an offer. The formulation of the plan to purchase the home and the felt sense of motivation to do so come together to create the experience of desire.

Translating and Defining Chanda

Perhaps the largest and most enduring misunderstanding of Buddhism in the west is that "all desire is bad". The core root of this problem is that translators of the suttas often used the same word "desire" to translate two different Pali words: one being "*chanda*" and one being "*tanha*". Desire (*chanda*) is neutral and represents a general sense of wanting something or having a goal. People can desire either wholesome or unwholesome things. Craving (*tanha*), by contrast, is always problematic. We will first look at desire (*chanda*) in this chapter before exploring craving (*tanha*) in the next.

To kick off the discussion of defining and exploring chanda, let's look at one sutta where the Buddha unambiguously uses "chanda" in a positive context. In the *Padhāna Sutta* ("Effort Discourse" - AN 4.13), he has this to say:

*"Monks, there are these four right efforts. What four? [1]
Here, bhikkhus, a bhikkhu generates desire, endeavors,
arouses energy, upholds the mind, and strives for the non-
arising of evil, unwholesome states that have not yet*

arisen. [2] One generates desire, endeavors, arouses energy, upholds the mind, and strives for the abandoning of evil, unwholesome states that have arisen. [3] One generates desire, endeavors, arouses energy, upholds the mind, and strives for the arising of wholesome states that have not yet arisen. [4] One generates desire, endeavors, arouses energy, upholds the mind, and strives for the stability, the non-confusion, the increase, the abundance, the development, and the fulfillment of wholesome states that have arisen. These are the four right efforts."

This shows a clear example of desire (chanda) being wholesome and being used towards a positive end. Another example is found in the *Caṅkī Sutta* ("With Caṅkī Discourse" - MN 95):

"Then he settles faith in him; filled with faith, he approaches; approaching, he attends; attending, he lends an ear; lending an ear, he hears the Dhamma; having heard the Dhamma, he memorizes it; he examines the meaning of the teachings he has memorized; as he examines the meaning, the teachings are accepted through reflection; when there is acceptance through reflection, desire arises; having desire, he makes an effort; having made an effort, he weighs it up; having weighed it up, he strives; being resolute, he realizes the ultimate truth with the body, and having pierced it with wisdom, he sees it."

Having looked at two positive uses of chanda, let's look at an unwholesome one. In the *Sanidāna Sutta* ("With a Cause Discourse" - SN 14.12), the Buddha highlights two clearly unwholesome instances of desire:

"Bhikkhus, conditioned by the element of ill will, ill-will-perception arises. Conditioned by ill-will-perception, ill-will-thought arises. Conditioned by ill-will-thought, ill-will-desire (*vyāpādachando*) arises. Conditioned by ill-will-desire, ill-will-fever arises. Conditioned by ill-will-fever, an ill-will-search arises... Bhikkhus, conditioned by the element of cruelty, cruelty-perception arises. Conditioned by cruelty-perception, cruelty-thought arises. Conditioned by cruelty-thought, cruelty-desire (*vi-himsāchando*) arises. Conditioned by cruelty-desire,

cruelty-fever arises. Conditioned by cruelty-fever, a cruelty-search arises."

These examples illustrate how the desire of chanda can be wholesome or unwholesome depending on the nature of the desire and the context in which it happens.

Model-Free Desires and Model-Based Desires

There are two ways the brain is able to come to the conclusion that it desires something or desires to do something. The first way is "model-free" decision making. This is also known as "habitual" decision making. Model-free is much more ancient than model-based from an evolutionary perspective and is found in all vertebrate animals. This kind of habitual behavior is largely automatic and based on conditioned responses. Model-based desires are plans and goals that emanate from the full functioning of our five-aggregate decision-making processes. These future goals are based on complex models of reality and self-schema, both of which are processed by the default mode network. Model-free desires are usually about something right in front of us and model-based desires can range from immediate goals to plans that stretch over decades. Examples of a model-free desire are the real-time desire to eat a cookie when it is encountered, the desire to check our mobile phone that comes out of nowhere or a sudden urge to buy a game that you notice when browsing a store.

Model-Free/Habitual Learning and Dopamine

Our habitual and model-free desires to do something or obtain something are largely modulated by a neurochemical called dopamine⁸². When we are engaging in something that is pleasant in the moment, the pleasure centers in the brain are releasing pleasure chemicals to maintain our interest in continuing the activity. Crucially, this real-time enjoyment needs to be translated into learning so that the brain can remember that this pleasurable (life supporting) situation can be experienced again in the future. Having to learn everything anew at every point of interaction with the world would be too slow and cumbersome, especially for more complex animals such as

⁸² See (Hill & Wierenga, 2016)

humans. To solve this problem, animals use dopamine and the dopamine learning systems.

When something unexpectedly pleasurable is encountered, dopamine cells in the limbic system of the brain⁸³ briefly increase their firing. This “dopamine burst” is a trigger that something new needs to be learned. The key word in that previous sentence is “unexpectedly”. The dopamine learning system is triggered when something is better than the brain predicted or worse than the brain predicted. If your experience matches expectations, there is no new learning that is required. Once a surprising pleasure is detected, dopamine is then released into a target area in the brain called the striatum. For ease of remembering, we will call this the dopamine learning area.

In this dopamine learning area, dopamine encounters synapses containing information about what was happening right before the pleasurable reward. It takes an inventory of the event context. If we are talking about ourselves, it looks at what our actions were before the reward. It also looks for any specific sensory input that correlated to the pleasure. This chemical tag helps bond the context to a memory of the pleasure. When this process is complete, we have unconsciously learned something new about what facilitates survival in our environment.

After this initial learning event there can be further refinement. The contextual cues that reliably predict reward will start to activate the amygdala when similar situations are encountered again. Most people know the amygdala as the “fear center” of the brain, but more accurately it is the “what is important to my survival” part of the brain. When you encounter contextual cues that had previously been tagged by the dopamine learning system, the amygdala will light up and nudge the dopamine learning system to pay special attention. If the incoming reward arrives exactly as expected, dopamine activity stays closer to baseline because there is nothing new to learn. If the reward is bigger than expected, dopamine levels will rise and strengthen the contextual cue to reward magnitude correlation. If the reward fails to appear as expected, dopamine activity dips, which helps weaken the correlation. Over repeated experiences, this sequential loop: (1) prediction (2) outcome comparison (3) synaptic updating is how the brain learns which contextual cues and choices are likely to lead to pleasure later.

⁸³ Specifically, the Ventral Tegmental Area and substantia nigra

Incentive Salience

Scientists describe this cognitive and bodily state of having the urge to fulfill a desire as “incentive salience”⁸⁴. Incentive salience is a “wanting” mechanism in the brain that transforms the perception of an otherwise neutral object, scenario or situation into something attractive and worth pursuing. Unlike “liking,” (*vedana*) which is the real-time pleasure you feel when encountering something that evolution has determined is conducive to survival, incentive salience is the magnetic pull that makes you want to pursue something in the future. It may be the immediate future, but it is the desire you have to approach and obtain something or the desire to do something you are not currently doing. When your brain assigns high incentive salience to a cue, like a sign for your favorite restaurant or the notification sound on your phone, it grabs your attention and generates a bodily urge to seek out the associated object, scenario or situation to obtain an anticipated reward.

Model-Free/Habitual Desire in Action

Once the brain has solidified associations between contextual cues and expected reward, the role of dopamine shifts dramatically to support incentive salience. In the learning phase, dopamine fired when you received an unexpected reward. Now, in the incentive salience phase, dopamine fires the moment you encounter the learned cue. When the amygdala spots a familiar trigger, like a sign for your favorite restaurant, it instantly alerts the dopamine cells in the midbrain⁸⁵. These cells respond by flooding the dopamine learning area with a surge of dopamine indicating that a potential reward is possible. This spike is not a feeling of satisfaction. Rather, it is a feeling of anticipation.

This initial chemical surge is what triggers incentive salience. It grabs the brain’s attention, making the contextual cue suddenly stand out from the background noise of everything else we are perceiving. If the contextual cue was a pleasant interaction with an object, the object becomes attentionally magnetic, giving us a felt sense of anticipation that motivates us to want to repeat the pleasant experience with the object. If it was a sequence of actions that we performed that led to the reward, a similar situation in which you performed and were rewarded will be the contextual cue. When we encounter that situation again, the incentive salience will be a magnetic urge

⁸⁴ See (ScienceDirect, n.d.)

⁸⁵ The Ventral Tegmental Area

to engage in the actions that rewarded us. Whether the cue is an object or a behavioral context, once we encounter it our attention will be strongly directed towards wanting to repeat the pleasure.

This incentive salience urge can trigger physical action. Because the dopamine learning area is deeply integrated with the brain's motor control centers, this chemical wave does more than just make you want something it primes your muscles to obtain the object or to engage in specific rewarding behaviors. It energizes the "Go" pathways in the brain, often initiating movement toward the reward before you have even consciously decided to act.

Model-Based Desires and Dualistic Conceptualization

Model-based desires are the result of the full functioning of the five-aggregate decision-making process. Remember that in the processing steps of the *samskara* (decision making) aggregate, one of the key inflection points is that a subconscious analysis needs to be made on whether we should fall back on habit or proceed forward with the full deliberative process. When we move forward with a deliberative process it becomes model-based and we then make use of logic, internal models of reality, self-schema and simulations of the future to arrive at a solution that has the highest estimated subjective (feeling-tone) value. One of the key inputs into five-aggregate decision-making process is the dualistic conceptualization that comprises our self-schemas. What we desire can be heavily influenced by dualistic conceptualization and its ability to conceptualize the world in very abstract and complex ways. The Buddha made this connection between dualistic conceptualization (*prapanca*) and desire explicit in the *Sakkapañha Sutta* ("Sakka's Questions Discourse" - DN 21):

"But good fellow, what is the source of what is liked and disliked?"

"Desire is the source of what is liked and disliked."

"But what is the source of desire?"

"Thought is the source of desire."

"But what is the source of thought?"

"Judgments driven by dualistic conceptualization are the source of thoughts."

Model-Based/Goal-Directed Incentive Salience

When exploring model-free desires we saw that once the brain has solidified an association between contextual cues and reward, incentive salience can make that potential reward attentionally magnetic. Incentive salience creates an urge in us to fulfill the desire. A similar dynamic can occur with model-based desires and the goals that they generate. The goals generated by the five-aggregate decision-making process can be picked up and focused on by the dopamine-driven incentive salience system which makes that goal attentionally magnetic. This creates a dopamine-driven urge to fulfill that goal. For example, in the “unusual apple in the apple orchard” scenario, once we had decided to investigate the out-of-season apple, that particular goal becomes the subject of incentive salience. The goal itself will grab our attention, and we will feel a motivational drive to fulfill it. Likewise, in the example we started this chapter with, once we arrived at the plan to buy that particular house, the dopamine system works to produce the urge to fulfill that plan.

Part 3 - The Causes of Suffering

13 - CRAVING (TANHA)

Desire becomes craving when we become mesmerized by the potential pleasures or survival implications of obtaining a desired goal. This mesmerization is driven by the default mode network's self-referential narrative simulations of these potential pleasures or survival implications. When these simulations of the narrative self become uncontrolled, they create the conditions under which clinging and suffering can emerge.

Craving is Problematic

Up to this point, everything we have discussed in this book about the functioning of the human brain can be considered “adaptive” and helpful for survival in the world that we live in. Adaptive means that something is conducive to survival and will help us flourish when engaging with the world. From this purely “let’s successfully engage with the world” perspective, having a functional five aggregate decision-making system is beneficial for survival. Being able to differentiate your body from the rest of the world, having a sense of self identity, the ability to recognize and categorize objects, and being able to make a decision that helps you survive all are adaptive qualities a person can have. You need to have all of these cognitive functions to successfully survive in the world. Likewise, being able to focus concentration on something or being able to come up with productive plans and then feeling an urge to do so are examples of adaptive qualities that help us successfully survive in this world.

Now we turn our attention towards the Buddhist concept of craving. As we encounter craving (*tṛṣṇā* in Sanskrit) which translates most directly to “thirst”, we will be switching modes, and we will be looking at how the brain’s adaptive features can go wrong and make us suffer. We will see how they can become quite *maladaptive*. This planet is full of people frequently struggling with disappointment, dissatisfaction and suffering and we will

learn in this and subsequent chapters that this is due almost entirely to craving and the sequence of brain activity that it triggers.

As an example of craving in action, let's consider the scenario where we decide to buy a house and after a bit of house hunting, we use five aggregate decision-making functionality to identify a house purchase. So far, so good. As just described, there are no dynamics here that can escalate to disappointment, dissatisfaction or suffering. When we initially engaged in the five-aggregate process to decide what house to put an offer on, valuation was the "currency" used by the brain to determine which options to choose. The brain ran simulations of purchasing and living in particular houses and then decided which one, on the whole, would potentially feel best to buy and live in. Again, there is no problem here. It would be rational and wise to choose the home that would feel best to purchase and own when all important factors are considered. The analysis, "taking into consideration my values, the qualities of this house and my budget, it would feel best to own this house rather than another one" is a healthy and important type evaluation to engage in. So far everything about the process has been adaptive.

After the decision has been made to purchase a particular home, the desire can transform into craving and become maladaptive. What transforms this adaptive and healthy desire to own a house into one that can cause disappointment, dissatisfaction and suffering is when we focus on the potential future pleasurable rewards of getting that house. This focus takes the form of narrative imaginings (simulations) of what owning the house will be like and the estimated good feelings owning our targeted home will bring. "Estimated good feelings" was part of the adaptive calculus in making a decision to buy the house, but when awareness of the "estimated good feelings" becomes an uncontrolled self-referential narrative focus on obtaining the estimated pleasure of owning the house, we have the potential for a real problem. Running self-referential simulations of the potential value of an outcome during decision making is not problematic but after that decision has been made, subsequent uncontrolled self-referential simulations set up the conditions for later grasping and suffering.

Craving As a Participant in Suffering

We saw that desire (*chanda*) can be variable in its wholesomeness and unwholesomeness. Craving (*tanha*), by contrast, is never shown in a positive light. It is always described as problematic and is stated to be the cause of grasping (*upadana*) and then suffering (*dukkha*). The most canonical exposition of the link between *tanha* and suffering is in the four noble truths. The

central sutta for this formula is the *Dhammacakkappavattana Sutta* ("Rolling Forth the Wheel of Dhamma Discourse" - SN 56.11). In it, the Buddha says:

"Now this is the noble truth of suffering. Birth is suffering; old age is suffering; illness is suffering; death is suffering; being coupled with the disliked is suffering; separation from the liked is suffering; not getting what you wish for is suffering. In brief, the five grasping aggregates are suffering.

Now this is the noble truth of the origin of suffering. It's the craving that leads to birth, mixed up with relishing and greed, taking pleasure wherever it lands. That is, craving for sensual pleasures, craving to continue existence, and craving for nonexistence."

Desire (*chanda*), by itself, is not necessarily a participant in the sequence of cause and effect that leads to suffering, but craving (*tanha*) is.

Three Types of Craving

In the *Dhammacakkappavattana Sutta* ("Rolling Forth the Wheel of Dhamma Discourse" - SN 56.11) the Buddha taught that there are three types of craving:

Now this is the noble truth of the origin of suffering. It's the craving that leads to future lives, mixed up with relishing and greed, taking pleasure there wherever it alights. That is, craving for sensual pleasures, craving for existence, and craving for nonexistence.

The first type of craving happens when the seeking of pleasure involves self-referential narratives around what it would be like to accomplish the goal of obtaining these pleasurable experiences. With this type of pleasure-based craving, evolution has all animals chasing the experience of pleasure because it is a motivating reward that encourages behavior deemed conducive for survival and procreation. The second type of craving, craving for existence, emerges because humans have the impressive capacity to think abstractly over long temporal timeframes which allows us to be explicitly aware of death. This results in motivations beyond simple survival instincts where we can be explicitly aware of the possibility of death and have uncontrolled thinking about wanting to survive. For example, if we are given

a medical diagnosis that threatens our survival, our craving for existence can be activated purely through conceptual abstract thinking.

The desire for pleasure is not the only thing that leads to craving. We can also have desires and craving that resolve around raw survival implications and these can come into play when making decisions. For example, when deciding between two houses to purchase, we might consider the possibility that one of them is in an area with increased wildfire potential. Living in an area that might kill you with fire is a reasonable factor to weigh when deciding where to live. I don't think anyone would argue that we shouldn't take survivability into consideration when making decisions. Just as is the case for seeking pleasure, existence-based thinking only becomes problematic when it becomes uncontrollable after a decision has been made and a goal set.

In Early Buddhism, craving for non-existence is pretty much what it sounds like it is: the desire to not exist. When this desire becomes compulsive and driven by self-referential narratives, it becomes craving. As Buddhism developed through time, the idea developed that craving for non-existence could also include an aversion to unpleasant experience that does not necessarily include suicidal ideation. An example of this type of teaching can be found in the *Abhidharmasamuccaya* written by the Mahayana Yogacara sage Asaṅga :

"What is craving (tṛṣṇā)? It is the craving not to be separated from pleasant feeling (kāma-tṛṣṇā); the craving for the continuity of neutral feeling (bhava-tṛṣṇā); and the craving to be separated from painful feeling (vibhava-tṛṣṇā)."

Viewed this way, craving can include the desire to be separated from aversive entities or situations. For example, if someone has a physical injury or has run out of money and cannot pay their bills, it is possible to crave that both of these scenarios did not exist.

How Craving Emerges in the Mind

We have seen how craving involves uncontrolled attentional focusing on desires for pleasure, existence and non-existence. To understand how this compulsive desire emerges we now have to revisit a number of concepts we have explored in this book so far and then see how they work together to create the experience of craving. These are:

- Desire
- A Continuous Sense of Self
- Perception of Inherent Existence
- Identity Self
- Dualistic Conceptualization
- Narrative Self
- Attention
- Out of Intoxicating Survival Drives

We will now look at each of these steps in turn to see how they lead up to the experience of craving.

Craving and Desire

Desires become cravings when a narrative of pleasure seeking or survival consequences are projected upon them in an uncontrollable manner. Our desires emerge from the five aggregate decision-making processes and become goals. If a goal can be obtained in a matter of seconds or minutes, the goal is held in “working memory”. If not, it is moved to “goal storage”. Either way our brain’s salience network keeps an eye out for milestones and obstacles and alerts other parts of the brain that it is time to work on goal-acquisition⁸⁶. “Working on goal-acquisition” often involves rerunning self-referential and narrative-based simulations of perceived pleasure or survival benefits of obtaining the goal. The default mode network is the region that runs simulations of the future and works with subcortical reward centers⁸⁷ to determine how much self-referential value a particular choice has⁸⁸, and when uncontrolled, this is what transforms chanda into tanha. This uncontrolled focus on the pleasurable or survival implications can intensify the expectation of reward if the goal is met. Craving can be an ongoing process when the simulations of potential reward keep getting run during the goal attainment process. Each simulation can change how much we value a particular outcome from a self-referential perspective as we narratively consider different implications of obtaining the goal.

⁸⁶ See (Menon & Uddin, 2010)

⁸⁷ See (Gerlach, Spreng, Madore, & Schacter, 2014)

⁸⁸ See (Benoit, Gilbert, & Burgess, 2011) and (Benoit, Paulus, & Schacter, 2019)

Craving and a Continuous Sense of Self

A normal working brain produces a personal sense of existing as a continuous self. This continuous self is a baseline for craving to exist since there has to be a continuing “self” for there to be any concern about what will happen to us. If there is no sense of existence, who exactly could be doing that craving? This fundamental “I am” is the core perceptual illusion that creates the preconditions for there to be any personal concern at all. *This is illustrated in the Taṇhā Sutta (“Craving Sutta” - 4.199):*

“Mendicants, I will teach you about craving—the weaver, the migrant, the creeping, the grasping. This world is choked by it, engulfed by it. It makes the world tangled like yarn, knotted like a ball of thread, and matted like rushes and reeds, not escaping the places of loss, the bad places, the underworld, transmigration. Listen and apply your mind well, I will speak.”

“And what is that craving ...When there is the concept ‘I am’”

This sutta directly links the concept of “I am” to craving. In our scenario about purchasing a house, our sense of being a continuous entity is the first link of a chain of cognition that ultimately leads to craving. Just knowing there is a future as a self is needed to envision owning the house.

Craving and the Perception of Inherent Existence

In order to crave a particular entity or scenario or to wish that a particular entity or scenario would go away, we have to buy into the perception that it is indeed a discrete entity and scenarios in a world of entities or scenarios. We can see this cognitive process described in Nāgārjuna’s *Yuktiṣaṣṭikā* 46:

“When one maintains that things truly exist, one grasps strongly at harmful views. From those arise attachment and aversion, and from these, conflict.”

As we saw in a previous chapter, our ability to recognize entities as having continuous existence themselves is fundamentally built upon our memories

of them existing over time. Our brains stitch together these snapshots creating a perceptual sense of continuity of objects and phenomena in the world.

In our scenario about purchasing a house, our minds are creating distinct entities out of objects in the scenario such as “that house”, “my house” and even abstract concepts like “housing scarcity” or “bidding war”. An objectification that has lots of potential for grasping would be “my perfect house”. All of these types of entity reifications are possible because of an underlying capacity to sense and perceive continuity of inherent existence (self) in what we are perceiving. This duality is a crucial element in the construction of the cognitive activity of craving.

Craving and the Identity Self

In the “types of selves” framework we have defined for this book, the identity self is the collection of autobiographical beliefs that make up someone’s identity. It is composed of a schema of who we are and how the world needs to work in order for us to remain safe, secure and happy. This schema can contain mundane information such as someone’s age or address, but it also contains abstract beliefs about the self such as “I am a good conversationalist”, “things never work out for me” or “college will make me unhappy”. These are the collection of schematic beliefs about ourselves or the world that influence what type of dualistic conceptualizations might emerge when a desired plan has been formed by the five-aggregate processes and the mind has a moment to reflect on the consequences of the plan. An identity belief that might be relevant to the house buying scenario might be “Successful people own their own home” or “renting is a nightmare” or “my father doesn’t respect people who don’t own their own home”.

Craving and Dualistic Conceptualization

For craving to really have the “juice” to lead to suffering, we have to conceptualize that there is a significant amount of self-relevance to the object of our craving. Another way to say this is that conceptualizing the degree of pleasure that is at stake or the magnitude of the threat to our survival will be directly proportional to the intensity of our craving. Once a goal has been set by the five aggregate processes, the default mode network and its capacity to run simulations of the future and judge the self-relevancy drive the process of craving.

One framework for these types of dualistic conceptualizations can be found in the Lokavipatti Sutta (“The Failings of the World Discourse” - AN 8.6). In it, the Buddha explores what he calls the eight worldly conditions:

“Monks, these eight worldly conditions spin after the world, and the world spins after these eight worldly conditions. Which eight? Gain, loss, status, disgrace, censure, praise, pleasure, and pain. These are the eight worldly conditions that spin after the world, and the world spins after these eight worldly conditions.”

These are example contexts where specific dualistic conceptualizations will be highly influenced by the content of our self-identity schema. Beliefs we have about the world will be a filter through which we perceive scenarios and develop dualistic conceptualizations. In the case of us buying a house, there are a number of problematic dualistic conceptualizations that we could have that come to mind. We might conceptualize, “this is the perfect house”, “if I don’t get this house, I will never find anything I like”, “if I get this house, maybe it will make me more appealing as a partner and I won’t feel so lonely” or “if I get this house maybe my father will finally respect me”. All of these dualistic conceptualizations have the quality of being 1) self-referential and 2) having a “feel-tone” implication. The implication of these dualistic conceptualizations is that we will feel good if we get what we want. The higher the perceived physical or emotional pleasure a dualistic conceptualization has, the stronger the craving is.

Craving and the Narrative Self

An actively functioning narrative self is a prerequisite. This narrative self is what runs the self-referential narrative simulations of the future that allow us to imagine what potential rewards of goals might be. The process of generating these simulations involves the default mode network running the details of a scenario through the filters of the identity self and this creates the dualistic conceptualization elements of the narrative story that we envision. For example, the identity-self belief of “my father doesn’t respect people who don’t own their own home” can lead to the dualistic conceptualization of “if I get this house maybe my father will finally respect me”. One of the things your default mode network would simulate in this scenario is how good it would feel for you to have your father’s respect.

Even sensory-pleasure-based cravings are magnified with the sustained stories of the narrative self. We may desire the pleasure of eating at our favorite restaurant from a physical pleasure perspective and the self-referential narratives that emerge from wanting the sensory experience will amplify the perceived possible reward.

Craving and Attention

I have described craving as being uncontrollable a number of times in this section. This can make sense if we consider how attention works when we are engaged in craving. We can remember that the default mode network is what runs the narrative self's future simulations necessary for craving and this network is anti-correlated with the "what is happening right now" mode. For the simulations of craving to function, the salience network has to take control of our attention from us and initiate the craving. The craving is not something we purposefully invoked. It is invoked when the salience network is activated by a reminder, milestone or obstacle of the desired outcome of the goal that is being monitored. This will often involve our salience network ripping our attention from whatever is happening in the present and turning it towards mental time-travel. The salience network can even interrupt one simulation to run the simulation we were just reminded about. Craving can cause a sudden hijacking of attention.

Craving as Reward Prediction

We have seen how the experience of craving is the active process of the default mode network running simulations of the future and making an estimation of the self-relevant reward that is obtained if a goal is met. Scientists call this estimation a "reward prediction" and these predictions are fundamental to the process of how the brain generates suffering. The brain is a prediction machine, and this is the prediction that creates the preconditions to grasping and suffering.

14 - GRASPING (UPADANA)

We saw how craving is triggered when our attention is hijacked and our default mode network runs self-referential narrative simulations of the future to predict what the feeling-based reward would be if a goal is met. Often the next cognitive experience after craving is grasping. This is defined in many places in Buddhist texts, but one example is the *Mahātaṇhāsāṅkaya Sutta* (“Great Discourse on the Destruction of Craving” – MN 38) which states:

“Craving is a requirement for grasping.

This sutta then later explains what type of experience grasping can be:

“Thus, caught up in favoring and opposing, whatever feeling one experiences, whether pleasant, painful, or neither-painful-nor-pleasant, one embraces that feeling, affirms it, and remains fastened to it. As one embraces that feeling, affirms it, and remains fastened to it, attachment arises. Whatever attachment there is regarding feelings, that is grasping.”

Grasping is represented here as attachment based on “Favoring and opposing”. “Favoring and opposing” represents the preferred outcome encapsulated within the experience of craving. When we have attachment to preferred outcomes, this is the experience of grasping. A key phrase in this passage is “caught up in”. We have seen in this book how a loss of control of attention is problematic. “Caught” up implies a loss of volitional attentional control. This uncontrolled favoring and opposing can become the source of great suffering. The *Dutiyalokadhamma Sutta* (“Worldly Conditions Discourse” – AN 8.6) says of people whose expectations are not met regarding acquisitions, social standing, praise or pleasure:

“They favor the gain that has arisen and oppose loss. They favor the fame that has arisen and oppose disgrace. They favor the praise that has arisen and oppose blame. They favor the pleasure that has arisen and oppose pain.

Thus caught up in favoring and opposing, they are not freed from sorrow, lamentation, pain, mental distress, and anguish. They are not freed from suffering, I say.”

As was implied by the “caught up in” phrase we highlighted above, this suffering can be persistent and ongoing through the attachment of grasping. This persistent attachment is illustrated in this passage from Mālunkya-putta Sutta (“Discourse with Mālunkya-putta” - SN 35.95):

*Having [sensed something or cognized about something],
mindfulness is lost
as one attends to its pleasing feature.
With an impassioned mind one experiences it
and remains attached to it.*

*For that person, many feelings increase,
arising from [sensory experiences or cognition].
Covetousness and vexation afflict the mind.
Thus accumulating suffering,
Nirvāṇa is said to be far away.*

If there are salient sensory or cognitive experiences that capture our attention, we can become impassioned by it and remain attached to it in an ongoing manner that accumulates continual suffering. And as we have just seen, this is especially true when we have favored outcomes.

This chapter details the grasping and afflictive emotions that are triggered when the brain realizes that a goal (favored outcomes) will not be met (or might not be met) and then gets stuck within the resulting mental activity that can overwhelm the mind. Awareness of unmet goals generates unpleasant feelings of disappointment, dissatisfaction and suffering in proportion to how high our expectations were for a pleasant or survival-supporting reward. These punishing feelings are meant to motivate us to “fix” the fact that our goal is unmet. This process is especially challenging when we get attached and stuck on a particular missed goal for an extended period of time and experience the sustained “motivating” punishments of

disappointment, dissatisfaction and suffering. As we will see, the default mode network is heavily involved in the experience of being attached⁸⁹.

Translating and Defining Upadana

Grasping is a translation of “Upadana”. If we look at the etymology of the word “upadana” we can see that it has dual meanings. One meaning is “to pick up”. This is why some writers use the word “grasping” as a translation. It is the active mental action of grabbing onto something and not letting go. The other meaning of upadana is “fuel” or “nutrient”. Grasping fuels suffering. This implies an ongoing fueling of suffering by not relinquishing our hold on something. It implies an active and ongoing process.

There are four types of grasping in Buddhism. These are enumerated in the *Vibhaṅga Sutta* (“Analysis Discourse” - SN 12.2):

*“And what, monks, is grasping? There are these four kinds of grasping:
grasping at sensual pleasures,
grasping at views,
grasping at moral rules and religious observances, and
grasping at a doctrine of self.
This, monks, is called grasping.”*

Grasping at sensual pleasure is when we experience the disappointment of not having a goal met where an interaction with an object or scenario would bring direct sensory pleasure. Examples of this type of grasping might be disappointment at not getting a particular dessert you were looking forward to, not getting tickets to a concert performed by a favorite musician or having someone turn you down when you make a sexual invitation. In all three circumstances you envisioned a pleasant experience through a particular interaction yet were stymied. The dessert would have provided pleasure from the taste sense. The concert would have given pleasure from the hearing sense and perhaps the visual sense if there was a good light show. The sexual experience would have provided pleasure from the feeling sense. The magnitude of the resultant negative emotional response would be in proportion to how pleasant you expected the experience to be.

⁸⁹ See (Brewer, Garrison, & Whitfield-Gabrieli, 2013)

In those examples of grasping at direct sensory pleasure, the schemas of one's self-identity did not have much influence in the creation of the craving towards the objects. Perhaps the schemas would influence our preferences, but it was mostly just raw sensory pleasure, that is the goal. It was just the direct pleasure of the real-time interaction a person would be after. In grasping at views, it is another matter entirely. When we grasp at views, we are rewarded when our beliefs of how things should happen in the world are met. For example, when your favorite sports team wins a game, pleasure doesn't come directly from the senses, it comes from our conceptualization of the scenario. When expectations borne from our schematic beliefs and dualistic conceptualizations are not met, this creates the conditions under which we can get carried away by grasping. In some Buddhist texts that talk about grasping at views, they may list metaphysical declarations as examples, but more helpful to us are teachings that talk about view grasping in more general terms. For example, in the *Paramatthaka Sutta* ("The Supreme Discourse" - SNP 4.5), which is one of the oldest Buddhist teaching available to us, we can find view clinging talked about in a general sense:

*Whoever should take to himself certain views,
thinking them best, supreme in the world,
and hence he proclaims all others as low—
by this he does not become free from disputes.*

*In whatever is seen by him, heard, and cognized,
He sees profit in these;
and so from his grasping at that very view
all others he sees as worthless, as low.*

In our house buying example, the primary clinging driver was the conceptual dualistic view: "If I get this house maybe my father will finally respect me". The prospective pleasure would come from acceptance from the father, not from any direct sensory experience. The reward of buying the house would come from an abstract cognitive appraisal of the situation.

The next type of clinging defined is "grasping at moral rules and religious observances". This teaching was largely a message to the practitioners of the Buddha's time explaining that the Brahminic sacrifices and rituals they were engaged in would not bring liberation from Samsara. Perhaps this teaching would be most relevant to our time if we consider that we might possibly have an overly dualistic relationship with Zen services and precept practice and thus lose sight of the bigger goal of Zen.

The last type of grasping is “grasping at a doctrine of self.” There are no formal definitions of this type of grasping in the Early Buddhist texts that I have been able to find but you can find these definitions in later writings. For example, one text defines it this way:

“And what is ‘grasping at a doctrine of self’? Here a [non-awakened person], regards [the five aggregates] as self, or the self as possessing [the five aggregates], or [the five aggregates] as being within the self, or the self as being within [the five aggregates].

We have seen that the five aggregates (feeling embodied, experiencing feeling tones, recognizing and categorizing the world, making decisions and having differentiating awareness) are deeply connected to having a sense of self. Our perceptions of self and self-identity exist as filters and inputs into the five aggregates decision making process. Since we are having the perception of a first-person experience while the aggregate processes are in action, it feels quite real that this is what our self is comprised of. It can also seem like those processes belong to the self or that the self emanates from the processes. In another chapter we will explore why this is an illusion, but for now it is worth recognizing that it is an incredibly convincing illusion and it very easy to crave the scenario where we continue to exist and then cling to this intense desire.

A Concrete Example of Grasping

We can envision this process in action by revisiting the scenario where we are looking to buy a particular house that we found when house hunting. Our brains ran a five-aggregates decision making process and determined a particular house would be best for us. As we ran simulations of owning this home, one of the dualistic conceptualizations that emerged from the narrative was “if I get this house maybe my father will finally respect me”. This dualistic conceptualization greatly increased the predicted feeling-tone payoff of having the offer accepted. This increased feeling-tone payoff directly corresponded to how big of an emotional blow it would be if we did not have our offer accepted.

Let’s imagine we receive notice that we did not get the house. Since the perceived feel-tone payoff was significant, the emotional blow is significant. We are overwhelmed with disappointment. The emotional blow is big enough that we are having a hard time accepting that we did not get what

we hoped for. We find ourselves revisiting the scenario over and over again despite the fact that each revisit is unproductive and does not cover any new ground. Each revisiting prolongs our feeling of disappointment. This would cause us to become stuck. This is an example of grasping (upadana) in action. The main components are: 1) a strong experience of clinging that defines the nature and magnitude of our expectations, 2) having our expectations unmet and 3) prolonged unproductive rumination that extends our misery.

The Five Grasping Aggregates and the Asavas

Interestingly, one of the definitions of an awakened person that the Buddha puts forth is that they have the “five aggregates” but not the “five aggregates of grasping”. In other words, an awakened person feels like they have a body, can experience pleasant and unpleasant sensations, recognize and categorize what they perceive, make decisions and recognize that the objects they perceive are separate from themselves. What makes them stand apart from us non-fully awakened people is that they do not grasp at or because of these aggregates. For example, a fully awakened person would not grasp at the cookies their five aggregates desire and they also would not grasp at the desire that their teeth stay healthy enough to eat cookies. The grasping at the cookies is grasping *because* of the five aggregates and the grasping at healthy teeth is grasping *at* a component of the five aggregates. A fully awakened person would not grasp at either.

The difference between the five aggregates of grasping and five aggregates without grasping is explained in the *Khandha Sutta* (“Aggregates Discourse” - SN 22.48). First, the Buddha explains what the five aggregates with grasping are (This would be the type of five aggregates a fully awakened person would experience):

“Monks, I will teach you the five aggregates and the five aggregates of grasping. Listen to this.

And what, monks, are the five aggregates?

Whatever form there is, monks — whether past, future, or present; internal or external; gross or subtle; inferior or superior; far or near — this is called the form aggregate.

(The text then repeats this exact same formula for the remaining four aggregates: feeling-tones, perception, decision making, and differentiating awareness.)

These, monks, are called the five aggregates."

And then the Buddha explains what makes an aggregate grasping:

"And what, monks, are the five aggregates of grasping?

Whatever form there is, monks — whether past, future, or present... far or near — that is accompanied by intoxicating survival drives (asava) and prone to grasping, this is called the form aggregate of grasping.

(The text then repeats this exact same formula for the remaining four aggregates: feeling-tones, perception, decision making, and differentiating awareness.)

These, monks, are called the five aggregates of grasping.

We see here the difference between an awakened and non-awakened version of the aggregates is the inclusion of intoxicating survival drives (asava). Another way to say this is that the difference between a desired goal and craving for a goal is when the goal is cognized through a narrative self-referential simulation that uncontrollably focuses on the pleasure reward or survival implications of obtaining the goal. The greater the magnitude of the consequences, the greater the magnitude of the resultant grasping and suffering we will experience if the goal is not met.

Modes of Grasping

One of the best ways to understand how grasping manifests in our daily lives is to explore the different modes of suffering that lead to grasping which are enumerated in the first noble truth. A translation of the text is:

Now this is the noble truth of suffering. Birth is suffering; old age is suffering; illness is suffering; death is suffering; association with the disliked is suffering; separation from the liked is suffering; not getting what you wish for is suffering. In brief, the five grasping aggregates are suffering.

In this excerpt, the Buddha first lists out the most prominent sources of suffering that a human can encounter:

- Being Born
- Getting Old
- Awareness of mortality
- Experiencing unpleasant interactions or scenarios
- The loss of pleasant interactions or scenarios
- Not having our expectations met or successfully attaining our goals

After listing out these modes of suffering he explains that they can be summarized as the “five grasping aggregates”. They are modes in which we can grasp because of the aggregates or grasp at the aggregates themselves.

You might notice that the above list includes both pleasant and aversive experiences. In Chinese Chan (Chinese Zen), they tended to break grasping into two categories: pleasant and aversive. An example can be found in a famous Chan poem called the “*The Platform Sutra Huineng*”:

“If in all places one does not abide (zhù) in characteristics/marks (xiàng), and within those characteristics does not give rise to hate or love, and also has no grasping (qǔ) or rejecting (shě)...

In this chapter we will look at grasping at pleasant feelings or goals. We will look at “rejecting” in the Aversion chapter next.

Unobtained Favored Outcomes – Prediction Errors

When we crave something, the brain establishes a preferred outcome for how we want something in our life to turn out, while also making predictions about what is likely to happen and what the resultant feeling-tone consequence will be. When this prediction doesn’t come to pass as expected, scientists call this a “prediction error”. The human brain is a prediction machine, and it is constantly trying to guess what is happening. We can see these cognitive dynamics in play in Buddhist teachings. We saw the different modes of craving and clinging in the previous section. In all of these, we can see what the prediction error is.

As an example, consider the “association with the disliked is suffering” mode. If someone is in the beginning stages of encountering the negative

experience, the prediction error would be “I expected a more neutral, pleasant, safe, or controllable outcome than the unpleasant outcome I am actually receiving”. If the unpleasant experience has been ongoing, the prediction error might be “I expected this unpleasant experience to end and it has not.” An example of this mode could be visiting a family member, and they are having a bad day and are thus in a rotten mood. Dealing with them is unpleasant. You did not expect to have this aversive experience, and the prediction error makes the unpleasant situation more salient and prompts the brain to evaluate what it means for you, potentially adding disappointment, worry, or suffering.

Now let’s look at the mode, “separation from the liked is suffering”. Let’s say we had a grand piano that was given to us by a family member and we cherished it and planned to keep it for years to come. This plan is foiled when there is an earthquake and a heavy bookshelf falls on the piano and it is destroyed. The prediction error was “I expected to keep this piano intact and enjoy it for years, but it was destroyed”.

Our craving derived predictions are primarily the result of activity of the default mode network which we have seen is the seat of self-referential and time-traveling mental activity. Working with other brain networks such as the central executive network, it works to make a best guess estimate of what will likely happen in specific scenarios by running simulations. The salience network may then detect prediction error and alert various other large scale brain networks about the unexpected result. When the default mode network is alerted to the prediction error, it evaluates “what does this mean to me? How self-referentially important is this?”. If the prediction error resulted from an unfulfilled goal that had been set during the five aggregate decision-making process, there has likely already been some evaluation of consequences by the default mode network when the goal was initially set and then when the goal status was checked in on. If the prediction error is from an unexpected encounter, the default mode network needs to hurry up and see what the consequences might be. In both cases, a significant enough prediction error will result in disappointment, dissatisfaction or suffering.

You might be thinking, “but what if I predict that the bad thing will continue and sure enough it continues, would there be no suffering?” This is a very nuanced point. In practice, you are unlikely to just have the thought/prediction “this crappy thing is going to continue”. I suspect you will also have an even louder thought that “I don’t want this to continue”. You might predict that the bad thing will continue while still strongly preferring that it stop. The brain distinguishes between these two thoughts:

what you expect to happen and what you want to happen. A prediction that can become a prediction error if that crappy thing continues.

Grasping and Repetitive Negative Thinking

When we don't obtain what we want or expect, the resulting prediction error or mismatch with a preferred outcome can cause the default mode network to revisit its narrative simulation of the situation to determine what the resulting consequences are predicted to be. As the default mode network performs these simulations it engages in an analysis of the magnitude or seriousness of the consequences of not getting what we expected. Depending on how serious the consequences are, we might experience a corresponding negative feeling-tone "punishment" that is designed to motivate us to "fix" whatever prevented the preferred outcome from occurring. The higher the consequences, the more painful the motivating "punishment".

Remembering that one of the meanings of upadana is "fuel", we might wonder how the default mode network's narrative simulations might fuel disappointment, dissatisfaction or suffering in an ongoing manner. It obviously has to be something that is sustained and scientists call this sustained mental activity "repetitive negative thinking". Sometimes a single "rerun" of a simulation as a response to a prediction error is enough. If the consequences of the unmet expectations are not that serious, we can just become aware of it and move on. However, when the consequences of prediction errors are serious enough, the brain is likely to want to visit the issue over and over again until the problem is hopefully resolved. This results in the experience of repetitive negative thinking⁹⁰. In this type of thinking, there is a continual rehashing of the same issue over and over again in a manner that is difficult to stop. Repetitive negative thinking is where we become "stuck" when evaluating the consequences of not having a goal fulfilled (or potentially not having a goal fulfilled). This process is described quite clearly in this passage from the *Upādāparitassanā Sutta* ("Agitation through Clinging Discourse" - SN 22.7):

"That form of theirs changes; it becomes otherwise. Because that form has changed and become otherwise, their

⁹⁰ See (Jones, Papadakis, Orr, & Strauman, 2013)

differentiating awareness follows along with the change in form.

Agitation and mental states born from differentiating awareness following along with the change in form take over the mind and remain there.

Because the mind has been taken over, they become frightened, distressed, and full of longing; and through grasping, they become agitated."

Grasping is Emotionally Painful

Scientific studies show that continually thinking about something negative, which is essentially what ongoing grasping entails, is unpleasant and aversive. On one level that seems so obvious it almost seems like a waste of time to point it out, but I think it's helpful to really emphasize that allowing the brain to continually revisit and obsess about an issue in an unproductive manner just perpetuates suffering unnecessarily. Allowing the default mode network's narrative self to repetitively relive a realization of unmet clinging in this way fuels ongoing emotional distress.

The unpleasantness of this type of repetitive negative thinking is illustrated by a study⁹¹ led by researchers at the Pennsylvania State University. In this study, they conducted two experiments to examine what happens to people's emotional state while they engage in worry and rumination (types of repetitive negative thinking). Participants were deliberately instructed to spend periods worrying or ruminating, after which they rated how they felt. Both forms of repetitive negative thinking increased negative emotion and reduced positive emotion. This suggests that this type of repetitive cognition does not merely result because of distress but can actively make people feel worse. The experiment provided evidence that engaging in repetitive negative thinking can immediately spawn unpleasant emotional states, even over a relatively short period of time.

Another study wanted to see what the relationship between rumination and negative emotional feelings was when people were going about their daily life. They recruited 70 adult women and gave them handheld devices that prompted them eight times a day for one week. At each prompt, participants reported whether they were engaged in repetitive negative

⁹¹ See (McLaughlin, Borkovec, & Sibrava, 2007)

thinking and then asked them to rate how unpleasant, repetitive, uncontrollable, and abstract the thinking felt. The researchers found that repetitive negative thinking was strongly linked to unpleasant emotional feelings and a sense that the underlying situation was outside of one's control. Importantly, these characteristics appeared across depression and anxiety diagnoses, suggesting that repetitive negative thinking is a common psychological process rather than something unique to one disorder. They found that the more strongly people were ruminating or worrying at a particular moment, the more unpleasant they rated their thoughts at that same moment.

Grasping and Intolerance of Uncertainty

A scriptural example of the kind of repetitive thinking we have been talking about can be found in the *Platform Sutra of the Sixth Patriarch*:

Amid the good and bad, beautiful and ugly things of the world, amid enemies and loved ones, and when words sting, deception occurs, or arguments arise, regard it all as empty and do not think about retaliating. In each thought, do not keep thinking about the previous situation. If the previous thought, the present thought, and the following thought continue one after another without interruption, this is called bondage.

Thoughts “continue without interruption” when we experience unmet goals and thus prediction errors because humans are hardwired to dislike uncertainty⁹². If we cannot envision a clear path to meeting a goal, it makes us uncomfortable and the subconscious processes of the brain will continually wake up our central executive network and default mode network to nudge them to work out a solution that will allow the goal to be met. The greater the feeling tone or survival consequences of the unmet goal are, the greater the urgency will be in the subconscious's insistence that we engage in problem solving to find a new angle in how to obtain the goal. This is not necessarily problematic in all cases, as we saw in the attention chapter mind wandering (forced mental time travel) can be productive and helpful in some circumstances. If a session of repetitive thinking is productive, it might be helpful to be vigorously encouraged to keep at it. But when repetitive negative thinking is unproductive, then we are experiencing pointless

⁹² See (Huang, Yu, Carleton, & Beshai, 2019)

emotional pain with no payoff. In those cases, our repetitive negative thinking is emotionally punishing us for no reason.

The characteristic of the human brain feeling uncomfortable when a clear path to goal attainment cannot be envisioned is formally called “intolerance of uncertainty” by psychologists. One of the earliest studies to illustrate this effect was one conducted by a researcher named Daniel Ellsberg which was published in 1961⁹³. The study was designed to discover what people disliked more: bad odds or not knowing the odds. In the best-known example from the article, there was a container that contained 90 balls and of the balls 30 were red, while the other 60 were some unknown combination of black and yellow. When offered a chance to make bets, people overwhelmingly preferred to wager on red, whose chances they can easily calculate (exactly 1 in 3), rather than on a color whose true frequency was unknown, even though there's no logical reason the unknown colors should be any worse a bet. The study showed that people prefer uncertainty they can measure over uncertainty they cannot measure.

In another study, by researchers at the University College London⁹⁴, the goal was to determine what was more stressful: not knowing if something aversive will happen or the aversive experience itself. In this study, 45 healthy adults completed a learning task in which they repeatedly guessed whether a picture of a rock concealed a snake. If a snake appeared, they received a painful but tolerable electric shock. The chances of encountering a snake changed during the experiment in a way that participants had to continually learn how predictable the threat was. The researchers tracked stress through participants' ratings, pupil size, skin conductance and salivary cortisol, and used a computational model to estimate how uncertain each participant believed the situation to be. Stress was greatest not simply when shocks were frequent and predictable, but when participants believed that a shock and no shock were about equally likely. This 50/50 chance made it impossible for the participants to guess what the likelihood would be if the next card was going to shock them or not. Their personal estimates of uncertainty predicted their stress better than actually getting shocked did. The uncertainty of whether an unpleasant experience was coming or not was more stressful than the unpleasant experience itself.

Grasping is defined as a process that fuels ongoing suffering when outcome predictions are not met. The fuel is the experience of repetitive

⁹³ See (Ellsberg, 1961)

⁹⁴ See (de Berker, et al., 2016)

negative thinking that is triggered by intolerance of uncertainty. Uncertainty about when or if a predicted outcome will ever be met or not.

Loss Rumination Grasping

This type of grasping is associated with the first noble truth grasping category called “separation from the liked”. In this repetitive negative thinking mode, we had something we valued and enjoyed but have since lost it. When a prediction is something like “I predict that I would feel better if I had my thing back”, the type of repetitive negative thinking that results is called “loss rumination”. Loss rumination involves a repetitive revisiting of that recognition that you no longer have something in your life that you cherish. As you are stuck in mind travel to the past, your mind fixates on what is gone by continuously replaying memories, focusing on the unfairness of the situation, and dwelling on the emotional pain of the absence of what you were separated from. Each cycle through the rumination loop keeps the emotional pain fresh and ongoing. If loss rumination is ongoing or particularly strong it might lead to diagnosable levels of depression. Like all forms of repetitive negative thinking, loss rumination is driven by intolerance of uncertainty. In the case of loss rumination intolerance of uncertainty can take the forms of thoughts like, “Who am I without this person or thing?”, “Will I ever feel better?” or “What will my life look like now?”

Disappointment Grasping

Disappointment rumination is a type of grasping that comes when we have expectations of obtaining an object or having a specific scenario turn out how we wish it to yet the expectation is not fulfilled. The type of default mode network derived craving predictions that could set up the disappointment are “If I get this thing my life will be totally better”, “that expensive wine will taste delicious” or “If this happens it will prove I have self-worth”. When these predictions don’t come through it creates the possibility that we won’t be able to tolerate the uncertainty of how it will affect us, how we might be able to regroup and try again or how we can cope with the disappointment.

Worrying Grasping

Unlike disappointment where our default mode network has us ruminate about the past and its consequences, worrying comes when the jury is still out on whether we will get what we want or not. If we can see a clear path to fulfillment of our plan to obtain an item or have a scenario work out how we want it to, there really are no problems. But if the default mode network can't see a clear path to success and the consequences of not obtaining our goal are serious enough, then we will engage in the repetitive negative thinking called "worry". With worry we are time traveling to the future and it is triggered by the intolerance of uncertainty of whether we will get what we want or not. The predictions created by the default mode network might take the forms of thoughts like, "If I get this job I will finally be happy", "owning that car will be incredibly fun" or "If my work friends hear I ate at this expensive restaurant my social status will increase".

Grasping and the Inevitability of Old Age, Sickness and Death

In the *Upādāparitassanā Sutta* ("Anxiety Because of Grasping" - SN 22.8), the text describes how grasping at the aging and sickness of the body can occur:

"And how, mendicants, does agitation through grasping occur? One regards form in this way: 'This is mine; I am this; this is my self.' That form changes and becomes otherwise. Because form changes and becomes otherwise, sorrow, lamentation, pain, mental distress, and anguish arise."

When we are young, we might have the prediction, "I am not going to have to worry about getting old or sick, I am sure I will deal with it fine". As we start growing older we might have the expectation "I won't break down until I am SUPER old" or "My current state of not having a major disease will continue." Despite our best hopes, impermanence can bring a wrecking ball to our predictions about old age, sickness and death.

For many if not most people, these existential black holes are the most fundamental issues they will face and those that are most apt to create the most profound manifestations of rumination and worry. The "stuckness" of grasping is almost directly correlated with the consequences of not having a craving met and life itself is just about as grave as a consequence can get.

The specters of old age, sickness and death are what drove the Buddha to leave everything behind and devote his life to spiritual practice. Zen master have historically asked their students, "have you resolved the great matter of life and death?"

15 - AVERSION (DVESA/ZENG)

In the previous chapters we looked at a scenario where we were looking to purchase a house, and a large part of the motivation was that we were looking for our father's approval. When our offer was not accepted, this would likely trigger an afflictive emotional response due to how much we had invested into having our expectations met. Kleshas are afflictive emotions that cause suffering and this is how they are created. They emanate from the mind when our craving and grasping are not fulfilled. The main root Kleshas are greed (*raga*), hate (*dvesa*) and delusion (*moha*). Delusion (*moha*) is the core affliction because it confuses us into thinking the illusory perceptions of self and which is the basis of the other afflictions. In this chapter we will focus on the root affliction of hate (*dvesa*).

From a second noble truth perspective, aversion is the "association with the disliked is suffering" mode of clinging/grasping. Instead of grasping for something, it is grasping at the desire to not have contact with something unpleasant. This link between grasping and aversion is illuminated by the 8th century Chan (Chinese Zen) master and scholar *Zongmi* in his work *Inquiry into the Origin of Humanity*:

"...because one does not understand that ... objects are falsely manifested from one's own mind, one grasps them as definitely existent; this is called grasping at phenomena.

"Because one grasps things in this way, one consequently sees a division between oneself and others, and grasping at a self is formed. Because one grasps the appearance of a self, one greedily [a klesha] attaches to circumstances agreeable to one's feelings, wishing to use them to nourish the self; one reacts with hatred and

aversion [kleshas] toward circumstances disagreeable to one's feelings, fearing that they will injure or trouble the self."

Aversion and Rumination

When we desire and then crave for an unpleased experience to end, the type of repetitive negative thinking is of the "rumination" type. We have seen that rumination is when our default mode network continually obsesses over a source of distress. The underlying distress might be something that happened to us in the past or it might be something unpleasant that we are experiencing in the present. Either way, the brain can get stuck in a cycle of obsessing about the cause of distress and what it means about our life. We also say that rumination of this type will be driven by some sort of intolerance of uncertainty. This may manifest with thoughts like "Will this feeling ever go away?" or "Can I even deal with this?". Often, we can become "distressed about being distressed". While rumination increases the chances someone may later develop a mental illness, even "mentally healthy" people tend however to spend way too much time living in the past or worrying about what a current distress means for the future. It can be like a trance state where we are completely divorced from the world around us and become obsessed with self-preoccupied thinking.

Anger

In Buddhism, the emotion of "anger" is considered a variation of "hate" (*dosa/dvesa*). Psychologists tell us that anger emerges when our brains recognize a blocked goal or a social rule violation. Noticing these violations can come in the form of thoughts like "People will follow the basic rules of society and act fairly" or "I am not going to have my goals blocked by other people". When people break these constraints and the consequences are considered more than trivial, this can launch a ruminative cycle in which the transgression and resultant anger will be revisited over and over again.

Anger based on social rule violations is illustrated in the *Āghātavatthu Sutta* ("Grounds for Resentment Discourse" - AN 9.29) which shows numerous permutations of perceived social violations leading to anger:

*"Mendicants, there are nine grounds for resentment.
What nine? Thinking: 'They did wrong to me,' you harbor*

resentment. Thinking: 'They are doing wrong to me,' you harbor resentment. 'They will do wrong to me,' you harbor resentment. 'They did wrong to someone I love,' you harbor resentment. 'They are doing wrong to someone I love,' you harbor resentment. 'They will do wrong to someone I love,' you harbor resentment. 'They helped someone I dislike,' you harbor resentment. 'They are helping someone I dislike,' you harbor resentment. Thinking: 'They will help someone I dislike,' you harbor resentment. These are the nine grounds for resentment."

A social violation that bothers many of us is the perception of being criticized unfairly. One sutta that shows this dynamic is the *Anumāna Sutta* ("Measuring Discourse" - MN 15):

"They're irritable, overcome by anger... They're irritable, and hostile due to anger... They're irritable, and stubborn due to anger... They're irritable, and blurt out words bordering on anger..."

When accused, they object to the accuser... When accused, they rebuke the accuser... When accused, they retort to the accuser... When accused, they dodge the issue, distract the discussion with irrelevant points, and display annoyance, hate, and bitterness"

Regarding blocked goals, we can find this passage in the *Bodhicaryāvatāra* (*The Way of the Bodhisattva*)⁹⁵:

"From the occurrence of the unwanted, or from the obstruction of the wanted, Hatred/Anger, having obtained mental unhappiness herein, Arises and destroys."

Once a prediction error is detected and determined to be a social rule violation or goal obstruction, brain regions that are involved with body arousal and action preparation are recruited as the first steps towards the initiation of an anger response. The survival purpose of this initial surge of anger is to bias our attention towards the source of anger and prepare us to

⁹⁵ The direct translation is "hatred", but the context is a section of anger so that is what they are referencing.

approach it in order to rectify whatever is seen as the problem⁹⁶. Normally when our brains detect a threat, we are put into a mode where movement is inhibited, but if the brain decides to rev up the anger system, this “freeze” instinct is turned off which allows us to approach the threat⁹⁷.

In the context of anger, there are two modes of goals that could be blocked: short-term goals and long-term goals. Let’s look first at short-term goal blockage. As an example, let’s look at a scenario where you thought you were going to get a discount at a store, but you did not. In that situation, your brain quickly recognizes prediction error as “this was worse than expected.”⁹⁸. In the case of blocked short-term rewards, this “failed reward” alert will generate a dopamine signal that will be the main alerting system that kicks off the process that might lead to an anger response. In that case, the salience network will evaluate the situation to determine if the unexpected outcome is important and obstructive⁹⁹ and recruit parts of the default mode network to evaluate how self-relevant the blocked goal is¹⁰⁰. If the default mode network says it is “self-relevant enough” and the salience network says it is “important and obstructive enough”, then the brain will be pushed into anger mode.

The detection of long-term goal blockages works differently, relying on triggered memory retrieval rather than real-time monitoring. For long-term plans, it is not feasible for the brain to constantly “hold” the goal in mind. Instead, an external event acts as a cue that triggers the hippocampus (the brain’s main cue-based memory center) to retrieve the specific goal “schema” from long-term memory¹⁰¹. The default mode network (the medial prefrontal cortex specifically) can instantly recognize retrieved concepts as self-relevant and activate the salience network to determine if there is a conflict with a goal. If there does seem to be a conflict, the default mode network (specifically the ventromedial prefrontal cortex) then can act as a self-relevance value-check and weigh the severity of the blockage against the subjective importance of the goal¹⁰². If the default mode network’s ventromedial prefrontal cortex confirms the goal is high value, it validates the

⁹⁶ See (Harmon-Jones & Allen, 1998)

⁹⁷ See (Harmon-Jones E. , 2003)

⁹⁸ See (Schultz, Dayan, & Montague, 1997)

⁹⁹ See (Menon & Uddin, 2010)

¹⁰⁰ See (Qin & Northoff, 2011)

¹⁰¹ See (van Kesteren, Ruiter, Fernández, & Henson, 2012)

¹⁰² See (Bartra, McGuire, & Kable, 2013)

salience network's alarm which sets up the preconditions to push the brain into anger mode.

An example of this process might be if you have developed a long-term plan to remodel your home. As your central executive network is envisioning the sequence of steps needed to accomplish this goal, a decision is made to use a specific paint "XYZ Eggshell Blue" on the exterior of the house. Since it is on sale now, you go to the store and buy enough to complete the task even though you know that the sale price would make it unreturnable. Then a few weeks later you are scrolling through the news, and you read that XYZ paint has been found to cause damage to wood. Even though you were not thinking about your plan, the semantic meaning of the news article cued the memory of the painting plan, and your salience network and default mode network went into action and determined that 1) your plan to use the paint has been blocked and 2) you can not return it for a refund. As a result of all this, your brain is pushed into anger mode.

Anger arising from witnessing social rule violations has a similar mechanism to that of blocked long-term goals in that it is based on cued memory retrieval of social schemas. When we view social rule violations such as unfair treatment or the breaking of social norms, social schemas can be retrieved from memory which in turn triggers analysis by the components in the default mode network and the salience network. The brain compares expected behavior to observed behavior and if there is a mismatch between predictions and reality, there will be an evaluation of the consequences of the unexpected behavior and whether it was an accident or purposeful¹⁰³. If the consequences are high and the act was seen as intentional, then the brain can be switched into anger mode.

When something blocks a goal or violates a social rule and the default mode network and the salience network have decided it is a big enough problem, the full "anger" mechanisms can become unleashed. One of the first things that can happen is that evolutionarily ancient survival circuits, including the amygdala and hypothalamus, can shift your body into action-readiness. At a physical level your heart beats faster, your muscles tense, and stress hormones and adrenaline-like chemicals are released into the bloodstream¹⁰⁴. At this point your body is ready to engage against the source of conflict. Since you are all revved up and ready to "fight", the salience network detects this and works with the default mode network to map the body state to the scenario that created it and we can consciously have

¹⁰³ See (Schultz, Dayan, & Montague, 1997)

¹⁰⁴ See (Ulrich-Lai & Herman, 2009)

the thought “I am angry”¹⁰⁵. Anger becomes subjectively aversive due to the inherent unpleasant and painful quality of the negative thinking that results from cognition around the anger-generating situation.

After a flash of anger, there is the possibility of quickly returning to a normal emotional state, but sometimes our minds can hold onto that anger and perpetuate it. During the continued duration of the anger, we continue to experience aversive emotional feelings. The brain will tend to maintain an anger state until the threat is no longer a focus of attention. It is also possible to conceptually reappraise a situation with the central executive network and come to a logical conclusion that the scenario being evaluated is not actually a threat or that the degree of threat was exaggerated. At that point the anger mode can be turned off, and we can start the process of returning to a more relaxed emotional state. Even if there is not a concrete threat directly being perceived in the present moment, the default mode network can perpetuate a state of anger through ruminative mental time-travel. Our narrative self can flare up into action and hijack our attention with rumination regarding self-referential consequences of blocked goals or social rule violations. It might time-travel to the past and replay provocations, run simulations of how we could have responded differently or engage in future-based revenge fantasy simulations. Our attention might get locked into “how dare they!” loops that self-perpetuate the anger.

Imagine we are in our “stroll through the apple orchard” scenario. This orchard is actually part of a neighbor’s property, and we have a long-standing invitation to walk through it whenever we want. As we are walking over to check out the unseasonable apple, the neighbor’s son comes roaring up on an RV and angrily yells at us to get off the property. For most people, this would almost certainly trigger an angry reaction. While one potential source of anger in this situation would be our short-term goal of checking out the apple being blocked, chances are the biggest trigger for anger would be the neighbor’s son breaking social rules. To start with, we did in fact have permission to be there, so for him to say otherwise would be heavily flagged as unfair by the brain. Second of all, even if they have changed their minds, his aggressive and rude way of communicating would have set off the “breaking social rules” alarm and set the conditions for any angry reaction. At this point it would not be surprising if our brains launch into rumination with repetitive narratives such as “How dare he be so rude!”, “I should have yelled back at him” (with a simulation of us standing up for ourselves) and

¹⁰⁵ See (Barrett L. F., 2017)

"This is so unfair!" Those negative thoughts would be experientially aversive and cause us a degree of suffering.

Fear

The *Upādāparitassanā Sutta* ("Anxiety Because of Grasping Discourse" - SN 22.7) has the following text that is relevant to fear:

"And how does grasping lead to anxiety? It's when an [non-awakened person] regards form as self, self as having form, form in self, or self in form. But that form of theirs decays and perishes, and consciousness latches on to the perishing of form. Anxieties occupy their mind, born of latching on to the perishing of form, and originating in accordance with natural principles. So they become frightened, worried, concerned, and anxious because of grasping."

When you encounter a potential threat, such as a curved shape on a hiking trail that looks like a snake, the brain prioritizes speed over appraisal accuracy to ensure survival. When attempting to determine if something is a threat, a false positive is unlikely to cause much harm, but a false negative can be deadly. This immediate reaction is processed by neural mechanisms that neuroscientists call the "low road"¹⁰⁶. In this pathway, sensory information travels from the thalamus (the sensory relay for the brain) directly to the amygdala, initially bypassing the higher-level cognitive parts of the brain entirely. The amygdala acts as a central alarm system. Once it has been triggered, it initiates an immediate defensive response before we are consciously aware of what is being perceived. This neural pathway is described as "quick and dirty" because it works with a low-resolution representation of an external stimulus. At that level it is just enough to trigger a jump-startle response which gives an organism a quick reaction to potential danger.

As the low road for fear appraisal is being activated, a second, parallel process is occurring simultaneously but at a slower speed. This is what neuroscientists call the "high road." In this pathway, the same sensory information travels from the sensory relay thalamus to the sensory cortex for a higher level and more refined level of processing. The "thinking brain" cortex analyzes the shapes, colors, and contexts of the objects and compares

¹⁰⁶ See (LeDoux, 2000)

what we know about them in memory. At this level there can be a realization that the "snake" we have just jumped back from is actually just a curved stick. If the cortex determines the threat is false, it sends inhibitory signals to the amygdala to suppress the alarm response and calm down the fear response¹⁰⁷. Having both low road and high road fear systems allows humans to have an instant survival reflex while maintaining the ability to also appraise situations with more precision and rationality.

If the amygdala is activated by the low road mechanism of fear appraisal, it triggers a cascade of physiological changes designed to prepare the body for the possibility of "fight or flight."¹⁰⁸ A hormone is released that travels through the bloodstream to the adrenal glands, prompting them to flood the system with cortisol and adrenaline. These chemicals cause physical sensations of fear. These chemicals cause the heart rate and blood pressure to skyrocket in order to pump blood to muscles. Additionally, breathing will quicken to better oxygenate the blood, and non-essential systems like digestion are temporarily suppressed to conserve energy for immediate physical exertion.

The acute fear response can degenerate into chronic stress when both the cognitive and chemical safety systems in the brain malfunction simultaneously. In a healthy scenario, ending the fear response requires an "all clear" signal from the analytically minded frontal cortex after it cognitively assesses that the threat has passed. The brain will also cease the emission of stress hormones when there is no longer any danger. Unfortunately, this system can break down during chronic periods of repeated fear responses. Chronic fear responses can release so much cortisol that it begins to impair the prefrontal cortex which can cause this rationally thinking part of the brain go "offline"¹⁰⁹ which removes the one thing that can reappraise a situation and determine that a threat is no longer in existence. Without this top-down control, the amygdala is free to continue its fear response and over time can actually grow stronger and more reactive. This leads to chronic states of stress.

I remember one time when I was driving to a medical center where I was slated to have a procedure that involved a needle going into my eyeball. I was not a big fan of needles due to some childhood trauma and getting a shot directly into my eyeball was pretty much one of the worst scenarios I could imagine. Occasionally during the drive my attention would be

¹⁰⁷ See (Quirk & Beer, 2006)

¹⁰⁸ See (Ulrich-Lai & Herman, 2009)

¹⁰⁹ See (Arnsten, 2009)

hijacked from my control and the prospect of what I was about to encounter would enter my awareness and cause me to have a mild fear response. It was interesting to watch it happen in real time. If I was focused on the mechanics of driving or was thinking about something else, I would be fine but the second my attention was hijacked I could watch my default mode network simulating the event and I could feel the embodied fear response flare up¹¹⁰. I always find it fascinating to use these types of scenarios as “practice opportunities” to watch how things unfold within awareness.

My attention was not hijacked that often or too strongly, so it was manageable, but this illustrates one of the downsides of being able to imagine the future. Whenever we are not otherwise engaged in an attention-demanding task, the salience network invites the default mode network to time-travel at will. Often this mind wandering will be benign, but if there is something potentially aversive on the horizon, the default mode network and its narrative self will fall into negative rumination about the perceived future threat. If it is possible to avoid this threat, it is possible that this rumination could be productive, but if the potential threat is exaggerated or it is unavoidable, then the rumination is unproductive and does nothing other than make us needlessly suffer. While I was driving to the medical office, the procedure was seemingly unavoidable, so the little spikes of stress brought about by the narrative self’s mind wandering and future simulation were completely useless. And spoiler alert, when I finally had my appointment, it turned out that the inflammation in my retina had gone down by itself, and I didn’t need to receive the injection after all. The imagined future that was making me uneasy didn’t even happen after all.

¹¹⁰ See (Schacter, Addis, & Buckner, 2007)

16 - SUFFERING (DUKKHA)

In the case we have been following where our house offer was not accepted, we saw that the unmet expectation causes us emotional distress. This prediction error was revisited again each time we cycled through the loop of rumination. This is because emotional suffering emerges when the mind is actively engaging in the appraisal that we have had an unfulfilled goal or expectation that had significant survival or feeling-based consequences. It can also be an appraisal that we might not have our goal or expectation fulfilled in the future. This chapter looks to formally define suffering, and we will inquire into the question of whether suffering can be defined as something separate from pain. It then looks at the neurological mechanisms that produce the subjective experience of suffering and offers an explanation of why this type of suffering exists.

Translating and Defining Dukkha

The most famous Buddhist teaching of suffering is the first noble truth. We have seen how it maps suffering onto many common encounters in life such as aversive encounters with things we don't like, not getting what we wished, getting sick, getting old or facing the prospect of death. The word being translated as "suffering" is technically the word for "pain". In contextual usage, *dukkha* might best be translated as "dis-ease" because it can include subtle experiences like feeling annoyed or weary and calling those "pain" might seem over dramatic.

Buddhism classifies *dukkha* into three categories: *dukkha-dukkhatā*, *vipariṇāma-dukkhatā*, and *saṅkhāra-dukkhatā*. Useful translations and definitions for them are:

- ***Dukkha-dukkhatā* (Ordinary Pain)** – The physical and mental pain that we feel from interacting with something. It can be the pain of stubbing your toe or the aversiveness of feeling jealous.
- ***Vipariṇāma-dukkhatā* (Pain from Change)** – The distress that comes when something we are enjoying changes.
- ***Saṅkhāra-dukkhatā* (Weariness Pain)** – This type of dukkha is notoriously difficult to comprehend, but we can define it as the inherent disquiet and unease we feel because life requires constant upkeep.

The first two types of dukkha are self-explanatory and don't need much elaboration, but it is worth diving into *saṅkhāra-dukkhatā* (Weariness Pain) a bit. The basic idea is that because the world is in constant flux, we can never fully mentally rest. It is kind of like the idiom "if it's not one thing, it is another". There is just an inherent annoyance in having to constantly adjust to life. A likely neuro correlate of this is the fact that sustained executive cognition is inherently aversive to use. Other brain functions like automatic perception and automatic feeling-tone awareness feel like they are "free". They never feel effortful or fatiguing when they are in use. The activity of planning and logical deduction however does have a recognizable effort cost that can be felt. Executive cognition quickly becomes unpleasantly effortful. That is why we often feel reluctant to study something or have to read through an operating manual. We know in our hearts that it can quickly become aversive just from the mental effort alone. The constant background awareness of knowing through experience that a changing world requires effortful and unpleasant cognitive work can lead to a weariness toward life itself. When you warn someone, "this is going to take a lot of work", the implied assumption is that "work" (aka effort) is something to endure so they need to steel themselves before they start. *Saṅkhāra-dukkhatā* (Weariness Pain) is a subtle background lurking recognition that life requires inherently aversive mental work that we inevitably will have to endure.

Why Pain Exists

Pain can be an alarm system and also a signal that an organism may need to rest and heal. Over the course of evolution, organisms that could detect and react to bodily harm survived and reproduced more successfully than those that couldn't. Pain is a very effective warning system. At a physical level it can alert us to burns, cuts, crushing pressure or different types of organ malfunctions. When the nervous system detects a problem, it

generates an unpleasant sensation that grabs our attention. Some reactions to pain are automatic. An example would be pulling our hand from a hot stove before we are consciously aware there was even a problem. Other times the alarm alerts us that we have to engage in a five-aggregate decision-making process to respond to current or potential damage. Ongoing pain can be a signal that we need to rest or change our behavior to repair damage. For example, the pain from a sprained ankle is a signal to keep our weight off of it¹¹¹. Resting while injured might be particularly important for an animal that needs to lay low while in a vulnerable state to avoid predators.

So far, we have talked about pain from damage to the body, but we can also feel discomfort from interoception sensations. These are sensations that are sent from the body and processed by the insula. They are signals that indicate how well the body is maintaining its homeostatic needs. If these homeostatic values get out of whack, then alerts are sent to the brain to let the organism know something might need attending to. The brain predicts what homeostatic values will keep it healthy and safe and then motivates action when there are prediction errors indicating a homeostatic value is not in a healthy range. To complete the loop, the organism then engages in behavior to put these values closer to what they predicted to be. Examples of interoceptive sensations are hunger, thirst, need to urinate, tiredness, emotional state and temperature. All of these sensations can be unpleasant which can motivate action.

Why Emotional Pain Exists

Pain was originally “designed” by evolution to alert an organism about physical damage or physical needs but as organisms became more cognitively sophisticated, there developed a need to generate alerts about things we can think about. For example, a survival need for humans is companionship. It is not an actual physical need like food, but rather an abstractly represented need and the brain can notice its absence. Since it is required for survival, thoughts that notice its absence can trigger a pain alert that lets us know action might be required. Our ability to generate plans and expectations with the five-aggregates also necessitates the need for emotional pain. For example, if our minds decide that if we become a rock climber, we will be happy, yet a fear of heights keeps us from doing it, we will be alerted with emotional pain that our plans did not come to fruition. The prediction

¹¹¹ See (Walters, 2019)

“I will be happy when I become a rock climber” creates the conditions for a prediction error if the prediction does not come true. The prediction error will be analyzed by the default mode network which will then signal that emotional pain needs to be generated. Another example might be that as we start to get to know someone for work, we find that they are fun and interesting, and we decide we want to be their friend. If our friendship overtures are rejected, we are going to feel the sting of emotional pain. Emotional pain is designed to motivate us to examine the scenario to determine what went wrong and what we might do to right the situation. As our examples indicate, most emotional pain revolves around social dynamics and unobtained goal objectives.

How the Brain Represents and Processes Physical Pain

When you experience something that can potentially physically damage your body, your nervous system detects these abnormalities and generates the sensation of pain. To see how this process works, consider scenarios such as when you stub your toe or touch something hot. This potential damage is recognized by specialized nerve endings called nociceptors which then fire and send signals up your spinal cord to the brain. At this point the brain splits the processing of the sensations across two parallel streams. One stream runs to sensory cortical areas¹¹², which figure out where the potential damage is and how serious it might be. The second stream runs to the salience network which generates the actual subjective feeling of pain. One of the core regions of the salience network is the insula and people who have damaged insulas can experience the strange scenario of knowing there is pain but not feeling the “ouch” of it. The pain lacks its “this is important and you should do something about it” motivational attribute.

Unlike the sharp, external alarm of a cut or burn, signals about your body’s internal homeostatic state travel through a different, inward-looking sensory system called interoception. Sensor cells located inside your organs and blood vessels constantly monitor your internal physical balance and send updates through the vagus nerve and spinal cord directly up into the brainstem and thalamus where core automatic survival needs like breath and heartbeat are managed. These interoceptive signals eventually converge in the insula region of the salience network. If the homeostatic values are out of whack, some level unpleasantness on the pain spectrum is generated to alert us to the problem.

¹¹² The primary and secondary somatosensory cortices

How the Brain Represents and Processes Emotional Pain

Unlike physical pain, emotional pain does not start with damage to the physical body or an out of whack homeostatic value. Instead, it begins when the brain recognizes that an event or thought threatens something we value. For example, this could be a social relationship failing or an expectation not working out. The salience network, semantic processing regions and sub-cortical brain regions can work together to identify the rough outline of an active-inference derived prediction error and trigger the pain regions in the salience network to register the initial subjective sensation of being hurt. The default mode network can then run narrative simulations that compare our past expectations to current reality to confirm the negative prediction error and then deepen the emotional pain we are experiencing in rough proportion to the magnitude of the calculated self-referential implications of the scenario. If we become stuck in rumination at this point, each iteration through the loop will repeat the same negative appraisal again and again, allowing the emotional pain to persist or return long after the original event has ended. We saw with physical pain that it registers as subjectively hurting with activation of regions in the salience network. The same general regions activate with emotional pain as well. In fact, the pain medication Tylenol can dull emotional pain in the same way it can dull physical pain. Interestingly though, while physical and emotional pain activate the same general salience network regions, the patterns are slightly different and can be differentiated with brain imaging studies. This has potential significance when we look at the difference between pain and suffering.

Is there a Difference Between Pain and Suffering?

One of the most common teachings you will hear from modern Buddhist teachers will be some variation of “pain is unavoidable, but suffering is optional”. I myself occasionally repeat that and it certainly reflects what I can anecdotally report about my own life. One problem with this though is that in the Early Buddhist texts there is not really a word that can be directly translated as “suffering”. There is however a distinction made in a scripture called *Salla Sutta* (“Two Arrows Discourse” - SN 36.6). In this famous sutta, they make a distinction between physical painful feelings and mental painful feelings. The sutta makes the contention that a fully awakened person can feel physical painful feelings and will never experience mental painful feelings. To illustrate this, the sutta uses the analogy of two arrows:

"When an unlearned ordinary person experiences painful physical feelings they sorrow and wail and lament, beating their breast and falling into confusion. They experience two feelings: physical and mental. It's like a person who is struck with an arrow, only to be struck with a second arrow. That person experiences the feeling of two arrows. When they're touched by painful feeling, they resist it. The underlying tendency for aversion toward painful feeling underlies that."

And this can be contrasted with the experience of an awakened person:

When a learned noble disciple [aka an awakened person] experiences painful physical feelings they don't sorrow or wail or lament, beating their breast and falling into confusion. They experience one feeling: physical, not mental. It's like a person who is struck with an arrow, but was not struck with a second arrow. That person would experience the feeling of one arrow. When they're touched by painful feeling, they don't resist it. There's no underlying tendency for aversion toward painful feeling underlying that.

Looking at this, we can see that the functional difference between the way an awakened person reacts to a painful feeling and the way a non-awakened person reacts to a painful feeling is aversion (*paṭigha* which is also translated as resistance). An un-awakened person feels resistance to physical pain, and this adds the second arrow which is painful mental feelings. When modern commentators say draw a distinction between pain and suffering, this is usually the sutta they point to. Pain is the initial raw unpleasant feeling and suffering is the aversion-created escalation to "painful mental feeling" which can take the form of sorrow, wailing, lamentation, breast beating and confusion.

The neuro correlates of this can be seen in our above descriptions of how physical and emotional pain operate. Looking at physical pain, the sensations start in your body cells that detect physical damage and then flow up nerve fibers until they reach the brain and converge in regions of the salience network, and the subjective feeling of pain is experienced. This is the first arrow. At that point, the salience network recruits other cortical

networks, including the default mode network, to take a look at the situation as well.

When the default mode network gets involved, it starts running simulations and checks in with its self-identity schema to get a sense of how serious the situation is from a self-referential perspective. At that point we can have narratives like “why me?”, “now I can’t run the marathon I have been training for and this is a nightmare”, “this is going to keep me from making a living and I am going to lose my house” or “how am I going to emotionally deal with this?” These dualistic conceptualizations of how bad the situation is from a self-referential perspective will directly lead to the default mode network connecting to the salience network and creating the felt experience of emotional pain. This is the second arrow. This second arrow is meant to motivate us to do something to change our negatively perceived future.

A quick note that there might be something else that differentiates physical pain and emotional pain (suffering) besides their differing sources. I mentioned earlier that physical pain and emotional pain light up the same regions in the salience network, but they do so in a different way. This can be seen as a physical manifestation of the different experiential qualities of the two types of pain.

The Default Mode Network’s Suffering Circuit

We have seen that the real-time activation of the default mode network’s narrative self produces clinging which in turn correlates with suffering when goals and expectations are not met. The question is how the default mode network might actually induce the feeling of negative emotion when it detects that there has been this prediction error. From what I have seen, this does not seem to be fully answered by science yet, but I would like to propose what I consider a likely circuit for this. I propose that the brain circuit that the default mode network generates this pain with passes through a brain region known as the subgenual anterior cingulate cortex. There are direct projections from a key valuation and simulation node of the default mode network¹¹³ into the subgenual anterior cingulate cortex and they are co-active during acute emotional pain.¹¹⁴ Aside from acute emotional pain, the subgenual anterior cingulate cortex also correlates with sadness and depression¹¹⁵. The subgenual anterior cingulate cortex itself projects outwards

¹¹³ The ventral medial prefrontal cortex

¹¹⁴ See (Kross, Davidson, Weber, & Ochsner, 2009)

¹¹⁵ See (Drevets, Savitz, & Trimble, 2008)

to regions associated with the experience of subjective pain including the insula¹¹⁶ which is a key brain region in the salience network. This seems to be a likely circuit from which the default mode network's self-referential activity within the functioning of the five aggregates is linked to suffering. When the default mode network detects missed goals or potential missed goals, it generates suffering in order to motivate us to do something to fix the situation that is being ruminated or worried about.

Nature Doesn't Care if We Are Happy

Most people would agree that it is unfortunate that our adaptive neurological abilities can so easily malfunction and cause us to suffer to such a degree. But from the perspective of evolution, the way our brains are built is not maladaptive at all. From evolution's perspective, humans have been an amazing success story. Our population is exploding and we are dominating this planet from a macro species perspective. Whatever our brains are doing, it's clearly working. The problem though is that evolution just cares about whether or not we are passing our genes down to the next generation. That is its sole definition of success. It could care less if we are happy or miserable during the process. In fact, maybe evolution prefers us to be a little unhappy and unsatisfied. Perhaps that helps give us a little push to try and erase that aversive feeling through survival benefiting behaviors.

Since evolution only cares if we are successful and doesn't care if we are miserable during the process, we need to take matters into our hands. Luckily, the same neurological tools that evolution built into us to process reality can be trained and utilized to transform our lives in ways that reduce or even eliminate human suffering. The primary neurological tool we can work with to accomplish this is the brain's capacity to purposely control its attention. In the next chapter we will see how our ability to purposely control our attention can become a superpower to completely transform our lives.

¹¹⁶ See (Joyce & Barbas, 2018)

Part 4 – The Solution to Suffering

17 - MINDFULNESS (NEN)

Let's revisit our house buying scenario in depth before we explore the topic mindfulness in this chapter. We followed the situation where we put an offer on a house and hoped to purchase it. Many factors may have gone into our decision make an offer in the house but one of the primary factors was a facet of our self-identity that represented the belief that "my father doesn't respect people who don't own their own home". This component of our self-identity's schema influenced the emergence of the dualistic conceptualization "If I buy this house, my father will respect me". We might also have the dualistic conceptualization "this housing market is in my favor, and my offer is competitive so I suspect my offer will be accepted.". This sets up the prediction: "I will buy this house, and my father will be proud of me." Since social approval is so important to us, there is a significant level of "feeling-tone" consequence embedded in the craving-driven simulations we have. These simulations will imagine what it will be like to live in the house and that it will feel like. This is all the activity of our narrative self. The default mode network simulates a story of what we want to have happen and creates expectations of what we would like to happen to optimize good feelings and reduce bad ones.

When our offer is not chosen, and we are unable to buy this house, the high level of feel-tone consequences translate into a significant amount of suffering. This suffering is triggered by the brain's recognition of the prediction error "I didn't get the house so my chance to earn my father's respect is not going happen!" Since this was deemed as very self-relevant by the default mode network, we fall into a downward spiral of disappointment-driven rumination. Each cycle through the repetitive looping of the rumination, we revisit the situation and our suffering is extended and perpetuated. So, what can we do about this? Let's take a look at this teaching from the *Mālunkyaputta Sutta* ("*Mālunkyaputta Discourse*" - SN 35.95):

Seeing a form, mindfulness is lost,

*When attending to a pleasing sign;
One experiences it with an infatuated mind,
And remains clinging to it.*

*He does not lust after forms,
Having seen a form with mindfulness established;
He experiences it with a detached mind,
And does not remain clinging to it.*

As we can see in the above excerpt, Buddhism includes a tool that can be a solution to this scenario. When we are not being mindful, we are apt to be caught by clinging to something. When we establish mindfulness, we can detach from our grasping and experience freedom from the expectations of the narrative self. Mindfulness disables active grasping activity and that in turn turns off our suffering as long as the mindfulness can be maintained.

Targeting the Narrative Self

As we have just seen in the above scenario, it is largely when the default mode network's processing of the time-traveling "narrative self" starts to go haywire while simulating the future that unnecessary human suffering emerges in our lives. The five-aggregate decision-making process is essential for our lives, so we would never want to get rid of it entirely; but if there was some way to keep it from malfunctioning then we could have the best of both worlds. Being able to retain our ability to make decisions based on the narrative self's memory-driven dualistic conceptualizations yet not having the process frequently break down and cause us to suffer would be a win-win scenario. Let's consider how we might be able to do this.

Since we need our narrative self and its dualistic conceptualizations for survival, we can't turn it off forever. People who have no narrative self would presumably require medical intervention because we need the narrative self's dualistic conceptualizations to help us know how to interact with the world. But if there was some way to modulate its functioning when it is breaking down, that would be ideal. In fact, there is a way, and that is making use of the inherent anti-correlation between it and the top-down attention brain networks.

In normal brain functioning, the narrative self exists as mental activity that is sometimes highly active and sometimes almost completely silent. When it is active, our attention becomes dominated by the default mode network and its dualistic conceptualization driven simulations of the future.

It performs this type of mental activity most often when we are day dreaming or weighing options during the decision-making process. The core distinguishing dynamic of the narrative self is its inherent quality as a time-traveling experience. When the default mode network's narrative self is running, it is recreating scenarios from the past and/or running predictive simulations of the future. It is fundamentally a time-traveling process. There of course can be adaptive uses of time-traveling simulations, but when the process becomes out of control due to grasping, cognitive time-travel becomes the root cause of our suffering and being able to control this time-travel through the use of attention is a critical element to stop suffering in its tracks.

Buddhist Teachings on Mental Time Travel

Given the centrality of uncontrollable self-referential time travel as the cause of human suffering, it should come as no surprise that there is a wealth of traditional Buddhist teachings on the subject. One example from the Early Buddhist texts is found in the *Ajjhattānattātītānāgata Sutta* ("The Interior as Not-Self in the Three Times" - SN 35.9):

"Mendicants, the [senses] of the past and future are not-self, let alone the present.

Seeing this, a learned noble disciple doesn't worry about the [senses] of the past, they don't look forward to enjoying the [senses] in the future, and they practice for disillusionment, dispassion, and cessation regarding the [senses] in the present."

In the *Bhaddekaratta Sutta* ("One Fine Night Discourse" - MN 131) the Buddha teaches that we need to transcend the seeking of pleasure through mental-time travel and to not get caught up in self-referential identification with what we experience in the present:

*"Don't run back to the past, don't hope for the future.
What's past is left behind; the future has not arrived;*

And how does one not run back to the past? It's when one thinks: 'I had such form in the past.' One doesn't find delight in that. 'I had such feeling ... perception ... choices

... consciousness in the past.' One doesn't find delight in that. That is how one doesn't run back to the past.

And how does one not hope for the future? It's when one thinks: 'May I have such form in the future.' One doesn't find delight in that. 'May I have such feeling ... perception ... choices ... consciousness in the future.' One doesn't find delight in that. That is how one doesn't hope for the future.

And how is one not caught up in present phenomena? It's when [awakened people] don't regard form as self, self as having form, form in self, or self in form. They don't regard feeling ... perception ... choices ... consciousness as self, self as having consciousness, consciousness in self, or self in consciousness. That is how one is not caught up in present phenomena.

An example from the Mahayana tradition on the importance of transcending self-referential time-travel is found in the Vimalakirti Sutra.¹¹⁷:

Because it departs from the defilement of self, the Dharma is without self. Because it transcends birth and death, the Dharma is without life span. Because past and future are cut off, the Dharma is without people [i.e. self].

Another example from a Mahayana source is this teaching from the Lankavatara Sutra:

Lord of Lanka, that which is spoken of as the past belongs to discrimination; as the past is thus a discriminated idea, even so are the ideas of the future and the present. Because of reality (dharmata) the Tathagatas do not discriminate, they go beyond discrimination and futile reasoning¹¹⁸...

From the early Chan (Chinese Zen) world we have these concluding lines of a poem called the Xinxinming :

Faith and Mind are not two

¹¹⁷ Translation from (Kumarajiva, n.d.)

¹¹⁸ Translation from (Suzuki, 1932)

*Not two are Faith and Mind.
The way of words is cut off
It is not past, not future, not present.*

And then a few centuries later in Chan history we have this excerpt from the famous master Hui Hai:

You must be cognizant only of the mind and not permit yourself to make judgements — that is, you must avoid evaluations in terms of good, evil, or anything else. Whatever is past is past, so do not sit in judgement upon it; for, when minding about the past ceases of itself, it can be said that there is no longer any past. Whatever is in the future is not here yet, so do not direct your hopes and longings towards it; for, when minding about the future ceases of itself, it can be said that there is no future¹¹⁹.

Here is an excerpt from Huangbo Xiyun who was also from the golden age of Chan but was a bit younger:

The bodhisattva's mind is like empty sky, totally relinquishing everything. 'Past mind cannot be attained' is relinquishing the past. 'Present mind cannot be attained' is relinquishing the present. 'Future mind cannot be attained' is relinquishing the future. This is what's called totally relinquishing the three-world life¹²⁰.

Another famous source is the Platform Sutra which has this excerpt:

Whether it's a past thought, a present thought, or a future thought, let one thought follow another without interruption. Once a thought is interrupted, the dharma body becomes separated from the material body. When you go from one thought to another, don't become attached to any dharma¹²¹.

There is a clear theme that exists across thousands of years of Buddhist history that transcending the self-referential and time-traveling mind is a

¹¹⁹ Translation from (Hai, 2007)

¹²⁰ Translation from (Xiyun, 2019)

¹²¹ Translation from (Pine)

crucial part of the awakening path. That along with strong evidence from neuroscience points towards this being a core aspect of Zen practice. This begs the question: What can we do about this? Luckily, we have the tool that we need already built into our brains. This tool is the power of our attention.

Skillful and Unskillful Attention

In Buddhism, it is believed that attention (*manasikara*) can be pointed towards things that are skillful (*yoniso manasikara*) or unskillful (*ayoniso manasikara*). In the *Paṭhamasekha Sutta* ("A Trainee Discourse" - Iti 16) the Buddha posits that the ability to control our attention skillfully is the most important factor in awakening:

"I do not perceive any other single factor that is so helpful to a practitioner, who has not yet attained the goal but dwells aspiring for the unsurpassed security from bondage, as this: skillful attention"

That is a pretty strong statement and when you see what can come from skillful attention, it is easy to see why. According to the Buddha's teachings, being able to control one's attention is seen as necessary if we want to be free of being controlled by the *asavas*. As a reminder, the *asavas* are when the drive to chase pleasant experiences and the drive to avoid things that will threaten our existence become uncontrollable. They are the mental phenomenon that transforms normal decision making and problem solving into maladaptive craving and suffering. On this topic of attention and the *asavas*, the *Sabbāsava Sutta* ("All the Intoxicating Survival Drives Discourse" – MN 2) has the Buddha saying:

"When you use attention skillfully, intoxicating influences don't arise, and those that have already arisen are given up."

Also:

Take a [practitioner] who, using attention skillfully, lives restraining the faculty of the [senses]. For the distressing and intoxicating survival drives [asavas] that might arise in someone who lives without restraint of the [sense faculties] do not arise when there is such restraint.

This same sutta explains how having our attention focused on mental time travel is the underlying source of these defiling *asavas*:

"Because of putting unskillful attention to what they should not and not putting skillful attention to what they should, unarisen intoxicating survival drives arise and intoxicating survival drives defilements grow.

This is how they apply unskillful attention: Did I exist in the past? Did I not exist in the past? What was I in the past? How was I in the past? After being what, what did I become in the past? Will I exist in the future? Will I not exist in the future? What will I be in the future? How will I be in the future? After being what, what will I become in the future?" Or they are undecided about the present thus: 'Am I? Am I not? What am I? How am I? This sentient being—where did it come from? And where will it go?'"

If it is implied in the *Sabbāsava Sutta* that the application of skillful attention is an antidote to this time travel and a Mahayana sutra called the *Śālistamba Sūtra* ("The Rice Seedling Sutra") makes this explicit:

"Whoever, monks, sees this Conditioned Arising... by means of skillful attention (yonīśas manaskāra)...

He does not run back to the past, thinking: 'Was I in the past? Was I not in the past? What was I in the past? How was I in the past?'

He does not run forward to the future, thinking: 'Shall I be in the future? Shall I not be in the future? What shall I be in the future? How shall I be in the future?'

He does not run to the present, thinking: 'What is this? How is this? Being what, what does this become? Where has this being come from? Where will it go?'¹²²

Why don't we simply just choose to always use our attention skillfully and avoid problematic mental time-travel? The answer is because our attention frequently has a mind of its own and is scattered. We have seen in the

¹²² Translation from (Reat, 1993)

previous chapter how our attention is frequently hijacked by craving and aversion. The difficulty in purposefully controlling our own attention is illustrated in a sutta called the *Tayodhamma Sutta* (“Three Things Discourse” - AN 10.76):

“When your mind is scattered you can’t give up unskillful attention.”

When we don’t control our attention properly, our mind spirals out of control in mental time-travel and then gets caught up in grasping, afflictive emotions and suffering. The consequences of not choosing to control our attention are significant as it is the root of suffering and turning one last time to the *Sabbāsava Sutta* (“All the Defilements Discourse” – MN 2) we can get what might be the most direct definition of wise attention in the suttas:

They [a successful practitioner] understands which things they should direct the mind to and to which things they should not direct the mind to.

The teaching is that we need to be able to point our mind towards where we want it to go. We need to be able to control our attention. This is the most important and fundamental mechanism in Buddhism.

Mindfulness (Sati/Smṛti/Nen)

If skillful attention is control of attention, then mindfulness is the result. Mindfulness is something that happens due to purposeful control of attention. It is the activity of being able to avoid mental time travel in order to stay present and hold something in our attention. The link between the invocation of attention and mindfulness is made explicit in the *Āhāra Sutta* (“Nourishing Discourse” - SN 46.51):

“And what, monks, is the nutriment that causes the unarisen mindfulness enlightenment factor to arise, and brings the arisen mindfulness enlightenment factor to full development? There are, monks, phenomena that serve as the basis for the mindfulness enlightenment factor. Frequently giving skillful attention to them — this is the nutriment that causes the unarisen mindfulness enlightenment factor to arise, and brings the arisen mindfulness enlightenment factor to full development.”

The most common translation for the Pali word “*sati*” and the Sanskrit word “*smṛti*” is “mindfulness”. A direct translation of those terms would be “remembrance” or “to remember”. It is the continual remembrance of holding something in attention. What type of things? Any object really. We can see this definition in *Asaṅga’s Abhidharmasamuccaya*:

“What is mindfulness? With respect to a remembered/recognized object, it is the mind’s non-loss (not-forgetting); its action is non-distraction.”

Really, it could be anything, but in the context of practice, it can be any target that keeps us present. Perhaps the most common object to focus on in the history of Buddhism is the breath, and instructions are found in the famous *Satipaṭṭhāna Sutta* (“Foundations of Mindfulness Discourse” - MN 10):

“Breathing in long, he discerns, ‘I am breathing in long’; or breathing out long, he discerns, ‘I am breathing out long.’ Or breathing in short, he discerns, ‘I am breathing in short’; or breathing out short, he discerns, ‘I am breathing out short.’”

The same sutta shows how this mindfulness can be taken “off the cushion” and into the world:

“Furthermore, when a mendicant is walking they know: ‘I am walking.’ When standing they know: ‘I am standing.’ When sitting they know: ‘I am sitting.’ And when lying down they know: ‘I am lying down.’”

“Furthermore, a mendicant acts with situational awareness when going out and coming back; when looking ahead and aside; when bending and extending the limbs; when bearing the outer robe, bowl and robes; when eating, drinking, chewing, and tasting; when urinating and defecating; when walking, standing, sitting, sleeping, waking, speaking, and keeping silent.”

The sutta tells us that practitioners can also be present with feelings and aspects of the mind:

*They meditate observing an aspect of feelings—keen,
aware, and mindful, rid of covetousness and displeasure
for the world.*

*They meditate observing an aspect of the mind—keen,
aware, and mindful, rid of covetousness and displeasure
for the world.*

Wise attention is focusing our attention, and mindfulness is keeping that focus continually on an object.

The Goal of Mindfulness

Before we turn toward a scientific exploration of mindfulness, let's take another look at the *Satipaṭṭhāna Sutta* ("Foundations of Mindfulness Discourse" - MN 10) again to see what it can tell us about the goal of mindfulness:

"This, monks, is the path leading in one direction: for the purification of beings, for the overcoming of sorrow and lamentation, for the disappearance of pain and mental distress, for the attainment of the right way, and for the realization of nirvana".

Unequivocally, the final goal of making use of mindfulness is full awakening and nirvana. But we can also wonder, might we also get some shorter-term benefits on the way to nirvana? Another scripture called *Vesāli Sutta* ("At Vesāli Discourse" - SN 54.9) has some good news for us:

"Monks, this concentration through mindfulness of breathing, when developed and heavily practiced, is peaceful and sublime, an unadulterated blissful abiding, and it immediately disperses and stills evil, unskillful states whenever they arise."

"Immediately disperses and stills evil, unskillful states whenever they arise" is what we are going to concentrate on here for the rest of this chapter. We are going to look at how mindfulness can immediately short circuit the repetitive negative thinking that can emerge from grasping and cause us to suffer in an ongoing manner. Mindfulness can indeed do this, and to understand how, we are going to review one of the best understood mechanisms

in the neuroscience of meditation and it involves how two core brain modes interact with each other.

Present Moment Mode and Narrative Self Mode Anti-correlation and Mindfulness

We saw in the chapter on attention (*manasikara*) that during normal waking consciousness, our mind is often switching between two different modes. The first mode is the self-referential and time-traveling narrative self mode that is driven by the default mode network. The second mode is the present moment awareness mode driven by top-down attentional networks. We saw that due to the physical design of the brain, these two attentional modes are largely anti-correlated. When one of them is active, the other will be automatically attenuated and vice versa. The salience network is in charge of determining if we need to pay attention to something important in the present moment or if it is appropriate to tune out the world enough that the mind can wander as needed.

Experientially, it is pretty easy to see this process at work. For example, if you are having a rough day and are ruminating or worrying too much, distractions such as playing a game or watching a movie are very effective at activating present-moment-awareness and shutting down repetitive negative thinking. I do crisis counseling work and when people are in crisis, I often try and get them to read a book, watch a movie/show or really anything that would capture their attention away from their spinning minds and it very often helps those in crisis. We also recommend something called the 5-4-3-2-1 Grounding Technique. It's a technique where we teach the patients to focus on five different senses while following an easy script that guides them through a process of focusing on each sense at a time. It helps people break free from the clutches of repetitive negative thinking by having them focus on their sensory experience of the external environment. It is quite effective.

There are scientific studies that provide empirical evidence that purposefully involving mindfulness can reduce rumination and afflictive emotions. One very relevant study¹²³ performed a meta-analysis on 27 previous experimental studies to test whether a single brief mindfulness exercise could immediately improve people's ability to regulate their thoughts, emotions, and attention. Subjects either engaged in mindfulness, distraction (such as reading) or were asked to do nothing (mind wandering). The

¹²³ See (Leyland, Rowse, & Emerson, 2019)

average mindfulness, distraction or mindfulness session in the experiments was around 10 minutes long and most of the subjects were new to mindfulness. The mindfulness techniques involved various practices such as focusing on the breath, bodily sensations, or other present-moment experiences. Even though most of the subjects were brand new to mindfulness and the sessions were only 10 minutes long, the subjects experienced improvement in the regulation of negative emotion compared with mind wandering. Importantly, mindfulness was as effective as distraction which points to directed and stabilized attention being the notable variable in helping people feel better.

Another paper that is relevant to our discussion details an experiment¹²⁴ conducted by researchers based out of the University of Melbourne that was focused on rumination directly. In this experiment, ninety-one Australian adults used a smartphone app for ten days that pinged them eight times a day. At each ping, they were randomly asked to either listen to a three-and-a-half minute guided breathing meditation or to a neutral background-noise clip and then rated how much they were ruminating on their problems and if they were feeling any afflictive emotions, they were asked how painful the emotions were. Because each person got both the mindfulness task and the control task (the random noise) at different random moments, everyone served as their own control comparison which let the researchers determine the meditation's effect within each individual. They found that right after doing the mindfulness exercise, people reported less rumination and lower negative emotion than after the control task. Again, given that these were people new to mindfulness and the sessions were short, it shows that purposefully controlling attention to attenuate repetitive thinking is a very approachable intervention that is available to anyone.

Temporarily Knocking out the Root of Suffering

Let's take a moment to consider what was likely happening in the ruminating brains of the subjects in the experiments. Based on what we have learned so far about perception and cognition in this book, we can form a very informed guess at what was likely happening in each moment of repetitive negative thinking that was occurring:

1. **Time-traveling Continuous Self** - The default mode network is able to sense the perception of existing across the passage of time due to episodic memories. This creates the perception of a personal continuous

¹²⁴ See (Bolzenkötter, Neubauer, & Koval, 2015)

self as well as continuous inherent natures for all the objects of perception. This sets up the necessary prerequisite for the functioning of the narrative self.

2. **Time-traveling Narrative Self** - Using the foundational capabilities of the five aggregates, the brain is able to perceive the world, categorize it and then make decisions on how to interact with it. The decisions are driven by the time-traveling simulations of the future by the narrative self. Each simulation makes a prediction of pleasure and survival consequences for the imagined scenarios. During the simulations, the social self and identity self are the filters through which the narrative self predicts the future. The self-referential beliefs of the identity self and the relationship concerns of the social self influence the narrative being created by the simulation and influence the imagined consequences of that scenario. The time-traveling narrative self exists only as long as the default mode network process that created it is actively running.
3. **Dualistic Conceptualization** - The decision-making aggregate makes use of dualistic conceptualizations while trying to determine the best course of action during the simulation. These are the thoughts that define the problem and predict the outcome.
4. **Prediction** - Based on the dualistic conceptualization of the narrative self's simulation, a prediction of the future is made. An important element of this prediction is what the reward will be if a goal/desire is accomplished.
5. **Craving** - Assuming the narrative self's simulations imbue the desire with predictions of consequential levels of pleasure and/or survival implications, the brain's attention will be hijacked, and the desire will be promoted to craving.
6. **Existing Expectations** - The brain predicts what it expects to happen, so it will work to try to bring about the strongly preferred outcome associated with the craving.
7. **Prediction Error and Suffering** - The brain keeps track of the goal to see how things are going. If reality differs from what was predicted, this creates a prediction error. Even if failure was expected, there can still be a painful mismatch between the predicted outcome and the strongly preferred outcome. The default mode network's recognition of this causes it to interact with the subgenual anterior cingulate cortex to kick off a neurological cascade that culminates in the experience of emotional suffering.

8. **Grasping and Continued Suffering**– As long as the goal remains unmet, the mind grasps at the situation due to its intolerance of uncertainty and continually reruns the narrative self’s simulation of the scenario in a loop. Each time through the loop renews the recognition that the preferred outcome remains uncertain or unobtained, fueling the ongoing emotional suffering.

As we look through this complex sequence of cause and effect and see how it creates and perpetuates suffering, we can see that it all depends on the foundational pillar of the time-traveling of continuous and narrative selves. If the root time-traveling is interrupted through invocation of present moment awareness, then the entire house of cards comes tumbling down. This is what mindfulness essentially is: a brute force interruption in the narrative self through the evocation of top-down present moment centered attention. Note that I said it is the narrative self that gets attenuated at this level and not the continuous self. Perhaps the primary reason is that my own anecdotal experience is that the continuous self largely remains intact during sensory-based mindfulness. Additionally, there are papers that show narrative self activity being attenuated by attentional focus¹²⁵, but none demonstrating “Clive Wearing style” continuous self attenuation or dissolution from regular mindfulness.

One last quick point I would make about this kind of “tactical mindfulness” is that it is my personal opinion that it does not make a huge difference what type of technique one uses. The most important thing at this level of practice is to engage attention in some manner and hold it. I believe that as one makes progress along the Zen path it becomes more nuanced and the type of meditation you do becomes much more important.

Practice Makes Perfect

Maintaining mindfulness in the face of adversity is not easy. It’s not like one slight interruption of the continuous self permanently disables a grasping session of repetitive negative thinking. Unless the situation is trivial, just moments after the interruption, the salience network is going to detect the prediction error all over again and restart the suffering loop. Maintaining mindful awareness in the midst of afflictive emotions is very challenging and the more intense the pleasure or survival implications of the scenario are, the harder it will be. This is why we practice Zen Buddhism. We can actually get better at mindfulness through specialized mind training. This

¹²⁵ See (Smallwood, Nind, & O’Connor, 2009) and (Iijima & Tanno, 2012)

mind training literally physically changes the structure and operation of the brain in ways that increase our capacity for mindfulness. We will explore this in future chapters.

Attentional Control vs New Philosophical or Psychological Insights

A salient observation to make at this point is that the life-changing transformations that come through mindfulness are not the result of any new philosophical or psychological insights we have gained. They result almost entirely from modulation and control of our attention. Mindfulness changes lives not because we replace one type of thinking with another type of thinking. Rather it changes lives because our attention relationship with self-referential thinking itself is transformed.

Mindfulness is just the Beginning

The discovery that simply by paying attention we can, at least momentarily, disable grasping-driven suffering is an incredible one. This facet of Buddhism can make a tremendous positive difference in people's lives all by itself. In fact, these mechanisms are largely what the modern secular mindfulness movement is based on. This is only one part of the larger mechanism of Buddhism, however. Ethical living, mental concentration and awakening all play important and crucial roles in the path to true liberation and peace. Mindfulness is really just the first step in the process and in fact it plays a crucial supporting role in all these other components of the path.

18 - MEDITATION (ZAZEN)

There is a story in Zen that goes something like this:

Mazu was practicing meditation at Chuanfa Temple on Mount Heng. He encountered Master Huairang, who recognized that he was a person capable of receiving the Dharma.

Huairang asked him, "Worthy one, what are you aiming at by sitting in meditation?"

Mazu said, "I aim to become a Buddha."

Huairang then picked up a brick and began polishing it in front of Mazu's hut.

Mazu asked, "What are you polishing that brick for?"

Huairang said, "I'm polishing it into a mirror."

Mazu said, "How could polishing a brick possibly make it into a mirror?"

Huairang replied, "If polishing a brick cannot make a mirror, how could sitting in meditation make you into a Buddha?"

Some commentators have taken this story to mean that there is no need for meditation to achieve something that is already innate in us and any effort towards awakening is itself dualistic and thus flawed. For someone to believe that meditation is not an important and necessary part of the Buddhist tradition though would need to ignore over 2500 years of documented teachings that both encourage and give instruction for meditation. Meditation is indeed extremely important. One way that it is important is that it provides the repetitive practice that makes "tactical mindfulness" more effective. As we increase our ability to purposely maintain a mindful state this increases our ability to reduce real-time clinging and suffering as it is encountered. Another reason meditation is important is because it provides access to brain states that normal "tactically invoked" mindfulness does not.

These states are shamatha (tranquility) and samadhi (meditative absorption). We will explain later why these are important. The last reason meditation is important is because consistent practice can neurologically transform the brain in ways that produce a deeper and more lasting freedom from suffering possible in a way that is not dependent on manual invocations of mindfulness or temporary brain states.

Types of Buddhist Meditation

In surveying the history of Buddhist meditation, one way to break up different meditation instructions into different categories is the following list. It is not necessarily exhaustive, but most types of Buddhist meditation seem to fall within these categories:

- **Focused Attention** – Taking control of attention and focusing it on a single point of concentration.
- **Open Awareness** – As the name implies, this is a more open and receptive form of meditation without any one single fixed anchor.
- **Heavenly Abode Meditations** – A set of practices designed to cultivate and radiate four wholesome qualities toward all living beings. These are loving-kindness, compassion, sympathetic joy, and equanimity.
- **Non-Dual** – A type of meditation designed to dismantle our transience vijñana-style object/subject duality.
- **Visualization** – This type of meditation involves intentionally focusing the mind on detailed mental images or scenarios.

Because of their prevalence in Zen Buddhism, we are going to primarily explore focused meditation and open awareness meditation.

Sensory Deprivation

There is no question that control of attention is the primary mechanistic driver of how meditation works. I think one overlooked aspect of meditation is sensory deprivation. In order to get a complete picture of how meditation functions, I think sensory deprivation needs to be taken into account. What originally led me to consider the importance of sensory deprivation was when I started noticing that even if I had a “failure” of a meditation

session where I could not control my attention at all for whatever reason, I would still feel like my mind was a bit quieter and I would be more in tune with my body after the session.

At first, I wondered if there was some sort of pavlovian association between the posture and the location and those mental states. While that might be some of the dynamic, I came to notice the biggest anecdotally observed correlation was from lack of external sensory experience. When I would “fail to focus” in louder areas or areas with more visual movement or complexity, I would get less of the “somehow I feel like I meditated anyway” effect. The quieter and less visually distracting the session, the more baseline benefit the meditation seems to provide even without concentration. I also remember one time I went into a meditation retreat (sesshin) where I had a major work issue on my mind that was important for me to figure out. I went into it with the understanding that I would probably have to spend a lot of time involved in mental planning and other executive mental activity and in fact that is just how I spent the first few days of the retreat. To my great surprise, I felt my grasping mind slowly quieting down anyway. The mental moments between executive planning were more quiet and less prone to complaint-based thoughts. I was more at ease and able to just abide without judgement. It was revelatory to me that simply sitting in a quiet and visually static environment was working some sort of magic all by itself.

There is some experiential validation to back up my experience with this phenomenon. In one study they utilized something called Floatation-REST to test what sensory deprivation does to the human mind. Floatation-REST is a technique in which a person floats in skin-temperature salt water in a dark, quiet environment designed to minimize sensory input, movement, and awareness of gravity and bodily pressure. In the experiment they wanted to see how engaging in this experience affected resting brain functionality. Forty-eight healthy adults were assigned either to three 90-minute flotation sessions or to an active control condition involving reclining in a zero-gravity chair in a quiet, dark room.

Functional magnetic resonance imaging scans taken before and after the intervention showed that Floatation-REST was followed by reduced resting-state functional connectivity within posterior parts of the default mode network and between these regions and somatomotor areas involved in representing the body. Participants also reported greater serenity and lower levels of anxiety after floating. Interestingly, the brain changes were not unique to floating. The chair-rest control group showed a similar, though generally less extensive, reduction in functional connectivity. It appears that

prolonged reduction of sensory and motor stimulation can temporarily weaken connectivity among brain systems involved in self-related thinking and bodily processing. This explains why just sitting in a sensory reduced environment of the retreat made my mind quieter and less complaint prone: it reduced the communication between the areas that are in charge of the complaining, which is the default mode network. We have seen how the default mode network is the seat of the narrative self which is the chief complainer.

Obviously sensory deprivation is not the entire picture. There is a tremendous amount of experimental evidence that attentional modulation itself powerfully attenuates and alters the functionality of the default mode network, and the mechanisms of how this works are well understood¹²⁶. It would seem that sensory deprivation and attentional control are able to tag team with each other to work on the relevant brain networks.

Meditative Tranquility (Shamatha)

If we stopped random people on the street and asked them what they thought the primary benefit of meditation was, I suspect the most common answer would be something akin to “stress relief” or “relaxation”. Where I live in the United States there is the idiom “find my Zen” which maps to “be able to relax”. While obviously this popularly imagined capacity for meditation to relax us is not the entire story of what it does, it is in fact an important part of the mechanisms of meditation.

Zen Buddhism itself does not have much to say regarding shamatha in its teachings. At least partially I think this is because Zen focuses on more advanced “wisdom” teachings and some other terms like samadhi subsumed some of its attributes. That said, I am going to briefly touch upon shamatha anyway because it’s an experience that commonly emerges from meditation and it’s worth exploring. Also, Dogen, the founder of Japanese Soto Zen, does describe zazen as being “the dharma gate of ease and bliss” so at a minimum it is worth addressing what he might be referring to.

A teaching on *shamatha* that can give some sense of how the Buddha saw it can be found in the *Bālavagga* (“Section on the Foolish” - AN 2.31). In this sutta, he explains how tranquility comes from the calming of an agitated mind:

¹²⁶ See (Brewer, et al., 2011)

"When tranquilly is developed, monks, what does it accomplish? The mind is developed. And when the mind is developed, what does that accomplish? Whatever passion is there is abandoned."

Shamatha is the stilling of negative emotion and the development of mind stability. The human experience of being in a state of tranquility or energized agitation is mediated by something called the autonomic nervous system. It is a subconscious system that manages all the essential survival functions that we never have to volitionally invoke. Examples are regulating our heartbeat and digesting food. This system is split into two complementary halves: the sympathetic and parasympathetic nervous systems. You can think of them as being analogous to the gas pedal and the brake pedal of a car. They work together to keep our bodies within the homeostatic ranges needed for survival.

From an evolutionary "design" standpoint, the sympathetic nervous system acts as the body's gas pedal and triggers our "fight or flight" response when we face a stressful, exciting, or dangerous scenario. When this system kicks in, it rapidly shifts our body's resources in a way that optimizes our ability to take immediate action to engage with what we are facing. It accelerates our heart rate to pump more oxygen to our muscles, dilates our airways so you can take in more air, and temporarily pauses non-essential processes like digestion. This rapid surge of energy prepares you to either confront a physical challenge head-on or flee the situation.

In contrast, the parasympathetic nervous system was "designed" by evolution to act as our body's brake pedal and is responsible for the calming its physiological processes. Someone coined the term "rest and digest" to describe the state that the parasympathetic nervous system pushes us towards and that is a great description. When we feel safe and relaxed, this system takes over to conserve our energy and handle routine internal maintenance. It slows our heart rate back down to a normal rhythm, constricts your pupils, and redirects blood flow back to your stomach and intestines so you can properly process the food you have eaten.

Over the years, studies have shown mixed results about how effective meditation can be in activating the parasympathetic nervous system to induce bodily tranquility. A 2025 review¹²⁷ and synthesis study surveyed 16 different studies of advanced meditation practitioners to see if they could determine if any patterns could be discovered. Some practices are

¹²⁷ See (Sezer & Sacchet, 2025)

associated primarily with parasympathetic activity, others with sympathetic arousal, and still others with combinations or alternations between the two. To try to reconcile these varied results, the paper's authors examined three key variables across the studies: the specific type of meditation practiced, the practitioner's precise level of expertise, and variations that would occur within a given meditation session. According to the studies reviewed, meditation practices involving quiet attention to breathing were more often associated with parasympathetic activity than highly effortful, feeling-based, or activating practices. They found that tranquil states did not necessarily start with the beginning of a meditation session and if it did come up, it could be later in the session.

One specific example of "quiet attention breathing" is diaphragmatic breathing. Diaphragmatic breathing is slow and deep breathing produced by purposefully contracting the diaphragm, so the abdomen expands during inhalation and contracts during exhalation, thereby reducing breathing frequency. This type of breathing was investigated in a 2017 study by researchers from China and the United States¹²⁸. In this study the participants were told to inhale deeply and then "exhale as slowly as they could." This implies that this is an extended outbreath as compared to the inbreath. This study did not specify, but most diaphragmatic breathing includes explicit instructions to extend the outbreath. The study included forty participants who were assigned to either a breathing-training group or a control group. The breathing group completed 20 sessions over eight weeks which had them practicing 15 minutes of diaphragmatic breathing per session while focusing attention on the breath and bodily sensations. Eventually they averaged about four breaths per minute. Compared with baseline, the breathing group showed lower levels of negative feelings, better sustained-attention performance, and lower chemical markers of stress. The authors interpret these results as evidence that sustained slow diaphragmatic breathing can reduce subjective and physiological stress while improving attention. It is suggested that this included parasympathetic activation, but they did not test specifically for that.

In Zen Buddhism, you will find this type of extended outbreath technique in some Rinzai lineages. These lineages typically highly value deep meditative absorption (*samadhi*) states, and interestingly, there is an Early Buddhist sutta that ties *shamatha* to *samadhi*. The *Kāya Sutta* ("The Body Discourse" - SN 46.2) says:

¹²⁸ See (Ma, et al., 2017)

“There is the sign of calm and the sign of non-scattering. Frequently attending carefully to these is the nutriment for the arising of the as-yet-unarisen awakening factor of samādhi, and for the development and fulfillment of the arisen awakening factor of samādhi.”

Meditative Absorption (Samadhi)

If wise skillful attention (*yoniso manasikara*) is choosing to direct the attention volitionally, mindfulness (*sati*) is holding something in attention, tranquility (*shamatha*) is a relaxed and peaceful body then meditative absorption (*samadhi*) is the resultant one-pointedness of mind. A shorthand way of saying this is: mindfulness is the activity and *samadhi* is the resultant experience. A formal definition of *samadhi* (we will leave it untranslated going forward) is found in the *Cūḷavedalla Sutta* (“*The Shorter Analysis Discourse*” - MN 44):

*“But, lady, what is samādhi?”
“Friend Visākha, the one-pointedness of mind is samādhi.”*

We can get a sense of what “one-pointedness” means by looking at *Paṭisambhidāmagga* 1.3 which says:

“The mind’s singleness, its non-distraction, is samādhi”

The “non-distraction” phrase is a crucial component of the definition. *Samadhi* exists when our attention is single-focused and not being distracted by other objects or phenomena. It is when our attention networks do not yank attentional control away from us.

A Mahayana sourced definition is found in the *Mahāprajñāpāramitā śāstra* (“*Treatise on the Great Perfection of Wisdom*”) and I share this here to show that the definition is similar across traditions:

“What is samādhi?”

When a wholesome mind remains in one place and does not move, this is called samādhi.”

Now let's look at what the purpose of samadhi is. The *Samādhībhāvanā Sutta* ("Ways of Developing Samadhi Further Discourse" - AN 4.41) lists four explicit purposes for *samadhi*:

"Monks, there are these four developments of samādhī: for dwelling pleasantly here and now; for attaining knowledge and vision; for mindfulness and clear comprehension; and for the destruction of the āsavas."

Remember that the *asavas* are the intoxicating survival drives that control our attention and cause us to grasp at clinging which in turn leads to suffering. One of the formal definitions of awakening (enlightenment) in Buddhism is the destruction of the *asavas*. The ultimate purpose of *samadhi* is that it primes the brain for awakening.

Later in this sutta quoted above they give a definition of what "dwelling pleasantly here and now" means. They explain that *samadhi* can produce a series of progressively deeper trance states. These trance states are called *jhanas* in Pali and *dhyanas* in Sanskrit (we will call them *jhanas* since that is the most common name in English). In some forms of Buddhism (like traditional Theravada) working through the stages of the *jhanas* is the primary mechanism of practice. Traditional Zen teachings hardly mention them at all and most Zen teachers these days would probably say that these and other trance states are signs that our practice is deepening, but you should be careful not to cling to them.

There are different experiential different modes of *samadhi* defined across that various Early Buddhist and Mahayana texts. There are two modes that have particular interest for us. One mode would be the classic "closed *samadhi*" where sensory engagement is reduced a single point of concentration is emphasized. The second is more of an open and receptive *samadhi* that has a more panoramic and dynamic attentional focus. One good textual example that defines these formally is the *Samādhībhāvanā Sutta* ("Ways of Developing Samadhi Further Discourse" - AN 4.41). It defines four types of *samadis* with two of them representing the two types we just discussed. Here is a description from the sutta of what we will call the "Closed Samadhi" state:

And what is the way of developing samadhi further that leads to blissful meditation in this life? It's when a mendicant, quite secluded from sensual pleasures, secluded from unskillful qualities, enters and remains in the first absorption ... second absorption ... third absorption ... fourth

absorption. This is the way of developing samadhi further that leads to blissful meditation in this life.

And here is a description of what we will call “Open Samadhi”:

And what is the way of developing samadhi further that leads to mindfulness and awareness? It's when a mendicant knows feelings as they arise, as they remain, and as they go away. They know perceptions as they arise, as they remain, and as they go away. They know thoughts as they arise, as they remain, and as they go away. This is the way of developing samadhi further that leads to mindfulness and awareness.

Meditation and Self

Many meditators experience temporary mind states related to perceptions of self. This can include alterations of self, reduction in self-processing and even the absence of self. We have already seen how a brute force invocation of mindfulness can attenuate the narrative-self. Other meditators report alterations of embodied self, perspectival self or continuous self. I have personally had these types of experiences while meditating. For example, I have felt distortions of my physical body where it feels like part or all of it disappears or body parts are out of proportion with the rest of my body. I have felt like the location of my body and where and my perceptual point of view became weirdly out whack. Other times I have felt deeper experiences where the separation of my being and other objects have a porous or even non-existent boundary. I have even felt like I didn't even exist. They all have to do with the normal perceived sense of self being disrupted. I found these types of experiences are far more likely to happen when meditating at retreats than when just doing my regular day-to-day meditation.

We can find artifacts of this facet of meditation in Buddhist texts. For example, in the *Ānanda Sutta* (“With Ananda Discourse” - AN 3.32), we can find this teaching:

Then Venerable Ānanda went up to the Buddha, bowed, sat down to one side, and said to him:

“Could it be, sir, that a mendicant might gain a state of samadhi such that there's no I-making, mine-making, or

underlying tendency to conceit for this conscious body; and no I-making, mine-making, or underlying tendency to conceit for externally for all signs; and that they'd live having attained the freedom of heart and freedom by wisdom where I-making, mine-making, and the underlying tendency to conceit are no more?"

"It could be, Ānanda, that a mendicant gains a state of samadhi such that they have no I-making, mine-making, or underlying tendency to conceit for this conscious body; and no I-making, mine-making, or underlying tendency to conceit for externally for all signs; and that they'd live having attained the freedom of heart and freedom by wisdom where I-making, mine-making, and the underlying tendency to conceit are no more."

Scientific studies have explored this dynamic of meditation attenuating different layers of self. One particularly good study¹²⁹ was run by a researcher out of Israel. In this 2024 study the lead researcher and his team asked forty-six experienced meditators to do something most people can't: deliberately dissolve their sense of being a self. Participants lay inside a magnetoencephalography (MEG) scanner, which measures the faint magnetic fields brain cells produce. While being scanned, the participants were asked to purposely invoke three different mind states: resting without meditating, meditating while holding a normal sense of self-boundaries, and meditating to let those boundaries dissolve. Afterward each person sat for a long, careful interview about what the experience had actually been like, and independent raters scored those interviews along dimensions including sense of agency, first-person perspective, and sense of being located somewhere. The experimental design was unusually rigorous for a meditation study: the predictions were registered in advance, the researchers analyzing the brain data didn't know which state was which, and dissolution was compared against ordinary meditation rather than merely against rest.

The findings came in two tiers of results, and the tiers corresponded to different depths of experience and different parts of the brain. At shallower levels of dissolution, which most participants reached, activity dropped across the sensorimotor and upper parietal regions near the top of the brain

¹²⁹ See (Nave, et al., 2021) and (Trautwein, et al., 2024). They both cover the same experiment and reading them together gives a full account of the findings.

and extended toward the temporoparietal area. What these participants described losing matches what those regions are known to control: the sense of being the author of their own actions became intermittent, and bodily sensations became vague and diffuse rather than clearly localized. This maps to the embodied and volitional selves that we defined in the Self (Atman) chapter and is consistent with the neuro correlates defined there. These shallow levels of self-dissolution also included some reduction in activity in the rear portions of the default mode network.

Deeper levels of self-dissolution were reached only by twelve participants of the forty-six. These participants who had the deeper experiences had more lifetime meditation hours than those with shallower experiences. Among the participants, those with deeper levels of self-attenuation reported experiences like consciousness feeling disembodied and non-locatable in space, subject and object distinctions disintegrating and, in two cases, a loss of self. In one of those cases, the participant reported encountering an unbounded field of being with no observer and no witness. Compared to those with shallower self-attenuation, those with deeper levels of self-attenuation or self-loss, activity dropped even more in the rear regions of the default mode network than it did for the shallow-experience groups.

In the Self (Atman) chapter, we saw evidence that the rear part of the default mode network was a convergence zone for the various types of self. It would appear there is a continuum where lighter levels of rear default mode network attenuation reduce some forms of self and deeper levels reduce or even knock off more fundamental “I exist” style perceptions of self. Agency and body sensation dimensions of self seem to go first, then location and viewpoint layers of self, then body/mind experience and finally self-existence itself. Back-end default mode network attenuation occurring during meditation tracks with research¹³⁰ that shows this region being anti-correlated with the main “what is happening in the present moment” networks and this is what is involved in meditation. Self-attenuation and self-loss are the direct results of activity of samadhi turning down the default mode network regions that produce these perceptions.

Another study¹³¹ that we can explore shows the neuro correlates of what is likely an even deeper state of meditation. This experiment included just one participant and was a study of an exceptionally experienced Tibetan Buddhist meditator with more than 50,000 hours of practice. It was designed to investigate the neural correlates of what the researchers called

¹³⁰ See (Zhou, et al., 2018)

¹³¹ See (Winter, et al., 2020)

“content-free awareness” which they described as a state of wakeful consciousness reportedly lacking thoughts, sensory experience, bodily self-awareness, and any sense of self, time, or space. The participant underwent two brain scans while first resting normally, then performing several attention and memory conditions, and finally meditating for 30 minutes. The researchers treated the final five minutes, during which he retrospectively reported entering the deepest content-free state, as the critical experimental period.

Compared with ordinary rest, this state showed increased functional connectivity within the primary present moment awareness network¹³² and reduced connectivity within the back end of default mode network,¹³³ and reduced coupling between the present moment awareness network and primary auditory cortex. Electroencephalography (brain wave tracking) also showed strongly increased theta power and decreased alpha power, while physiological measures suggested deep parasympathetic relaxation despite an increased breathing rate. The authors interpreted the pattern as a state of unusually stable attention in which both external sensory processing and internal self-related mentation had become functionally disconnected from conscious awareness, with backend default mode network disconnection potentially related to the reported disappearance of self, time, space, and internal thought. Since this is just one meditator, and an advanced one at that, we can’t reach any far-ranging conclusions from it, but it is another datapoint showing that deep meditative states can flow from the anti-correlation between the “this moment” attentional parts of the brain and the default mode network. Even extremely deep experiences like this one follow the same basic pattern that starts with light mindfulness and culminates in powerful trances. They all are driven by control of attention.

Focused Attention Meditation

In focused awareness meditation we place our attention on a single mental target and attempt to hold it there. Examples of a target might be our breath, a mantra, a koan or something we are looking at. We hold our attention as long as possible and then when attention starts to wander, we notice this and then reengage the attention onto the target. This process can involve

¹³² The dorsal attention network

¹³³ Especially between the posterior cingulate cortex/precuneus and the inferior parietal lobules

considerable concentration and often involves reduced awareness of external sensory information.

In the Early Buddhist texts, focused attention meditation typically involves attentiveness to the breath. For example, in the *Ānāpānasati Sutta* ("In and Out Breath Mindfulness Discourse" – MN 118) the Buddha provides these instructions:

"Here, monks, a monk having gone to the forest, to the foot of a tree, or to an empty hut, sits down cross-legged, holding his body erect, and establishes mindfulness (sati) to the front. Ever mindful he breathes in, mindful he breathes out.

Breathing in long, he understands: 'I breathe in long'; or breathing out long, he understands: 'I breathe out long.'
Breathing in short, he understands: 'I breathe in short'; or breathing out short, he understands: 'I breathe out short.'

We can also find many examples of focused attention meditation in the Chinese Zen (*Chan*) tradition. One of the first Chinese Zen masters was *Hongren* and a meditation manual exists that is attributed to him called the *Xiuxin yaolun* ("Treatise on the Essentials of Cultivating the Mind"). In this teaching we are shown that we need to guard the mind by keeping it still and not allowing discriminative thoughts to arise and focusing our attention on a mental representation of the Sun:

"The pure mind of all sentient beings is also like this [the sun]. It is only obscured by the dark clouds of grasping at conditions, deluded (discriminating) thoughts, afflictions, and views. If one can simply remain still and guard the mind, so that deluded thoughts do not arise, the Dharma of nirvāṇa will naturally become manifest. Thus we know that one's own mind is originally pure."

"If someone who is beginning to learn seated meditation wishes to practice, they should sit upright with correct mindfulness, close the eyes and mouth, and direct the mind's gaze straight ahead, at whatever distance seems appropriate. Form the perception of a sun and guard the true mind, allowing no thought to remain from moment to moment.

A classic example of focused attention meditation can be found in the commentary in a koan collection called the Gateless Barrier. In *Mumon's* commentary for the Mu koan¹³⁴ he writes:

To attain to marvelous enlightenment, you must completely extinguish all thoughts of the ordinary mind...concentrate your whole self into this Mu, making your whole body with its 360 bones and joints and 84,000 pores into a solid lump of doubt. Day and night, without ceasing, keep digging into it, but don't take it as "nothingness" or as "being" or "non-being." It must be like a red-hot iron ball which you have gulped down and which you try to vomit up but cannot. You must extinguish all delusive thoughts and beliefs which you have cherished up to the present.

A master from the same lineage but from a bit later in time named *Dahui* also talks about holding a koan in mind in a focused manner:

Simply keep bringing it to attention from time to time. When delusive thoughts arise, do not use the mind to suppress them. If you stop movement in order to return to stillness, that very stillness becomes all the more disturbed. Right there in the midst of movement and stillness, observe the koan phrase.

We can also find focused attention meditation instructions from a Soto Zen master from Japan named Keizan Jokin in his work *Zazenyojinki* ("Points to be Aware of When Practicing Zazen"):

If the mind wanders, place attention at the tip of the nose and tanden and count the inhalations and exhalations. If that doesn't stop the scattering, bring up a phrase and keep it in awareness - for example: "What is it that comes thus?" or "When no thought arises, where is affliction? - Mount Meru!" or "What is the meaning of Bodhidharma's coming from the West? - The cypress in the garden."

¹³⁴ A koan is Zen phrase or story that can be used for meditation and general inquiry.

Sayings like this that you can't draw any flavor out of are suitable.

If scattering continues, sit and look to that point where the breath ends and the eyes close forever and where the child is not yet conceived, where not a single concept can be produced. When a sense of the two-fold emptiness of self and things appears, scattering will surely rest.

Keizan is considered one of the co-founders of the Soto sect in Japan, which in modern times is mostly known for an open awareness practice known as *shikantaza*, so it is interesting to see him recommending focused attention techniques that include koans. You'll also find focused attention meditation in the North American manifestation of Soto Zen. It is not uncommon for students to first start out with the focused awareness meditation technique of breath counting and then graduate to the open awareness technique of *shikantaza* after they have achieved some stability of focus.

Open Monitoring Meditation

There are many meditation studies that make mention of open monitoring meditation or open awareness meditation. They are generally interchangeable terms and point to a technique of remaining broadly aware of whatever sensations, thoughts, emotions, or sounds arise moment by moment, without selecting a single object of attention or becoming caught up in what appears. I personally prefer "open awareness" as a term to describe this modality of meditation because "monitoring" can imply a "monitor" doing the "monitoring" and this can disappear as the meditation deepens. But since the scientific literature mostly uses "monitoring" we will stick with that. As defined in this book as a broad category, contemporarily common techniques like vipassana or shikantaza would fall into this category despite their individual nuances.

This type of open monitoring meditation dates from the earliest teachings of Buddhism. One example can be found in Sati Sutta - SN 47.35:

"Monks, a monk should dwell mindful and fully aware. These are my instructions to you.

"And how is a monk fully aware? Here, monks, feelings arise in a monk while being experienced; they remain

while being experienced; they pass away while being experienced. Thoughts arise while being experienced; they remain while being experienced; they pass away while being experienced. Perceptions arise while being experienced; they remain while being experienced; they pass away while being experienced. In this way a monk is fully aware."

A very non-dual description of this type of meditation can be found in *Māluṅkyaputta Sutta* ("Discourse with Māluṅkyaputta" - SN 35.95):

"Māluṅkyaputta, in things that are seen, heard, sensed, and cognized: in the seen there will be only the seen; in the heard there will be only the heard; in the sensed there will be only the sensed; in the cognized there will be only the cognized. When, Māluṅkyaputta, in things that are seen, heard, sensed, and cognized: in the seen there will be only the seen... in the cognized there will be only the cognized, then you will not have identity as a result of that. When you are not 'by that,' your identity will not be found within it. When your identity is not found within it you will be neither here nor beyond nor in between the two. This itself is the end of suffering."

We will find many open monitoring type teachings in Chinese Zen (Chan) such as this one from *Dunwu dasheng zhengli jue* ("The Determination of the True Principle of the Mahāyāna of Sudden Awakening"):

"How does one observe the mind? Turn the illumination back to the source of mind and observe the mind. If mental thoughts move, whether concerning existence or nonexistence, purity or impurity, emptiness or non-emptiness, do not think any of them. And do not even think about 'not observing.'"

Another Chinese Zen meditation manual from the 12th century called the *Zuochan yi* ("Instructions for Seated Meditation") has open monitoring type instructions. The manual provides some basic posture instructions (including keeping the eyes open) and then it says:

"Once the bodily posture is settled and the breathing regulated, relax the abdomen around the navel. Do not think

about good or evil at all. When a thought arises, immediately become aware of it. Once you become aware of it, it disappears. If you continue like this for a long time, involvement with objects is forgotten, and you naturally become a single whole. This is the essential method of seated Chan."

It goes on to talk about not getting distracted by hallucinations or mystical experiences and also explains the importance of developing samadhi (meditative absorption).

Another such teaching is from the scholar practitioner Zongmi:

"Abandon the branches and return to the root; turn the illumination back toward the source of mind."

And from the great master Huangbo:

"If in a single thought you can turn the illumination back, your whole being is the mind of the sage."

And lastly from the founder of Japanese Soto Zen Dogen:

"Learn the backward step of turning the light around and shining it back."

Some commentators suggest "turn the light inward" type of instructions are pointing to a "be aware of being aware" meditation instruction. I would argue that it is an open monitoring instruction. While resting in awareness itself, sensory and mind phenomena can pass into and out of awareness without friction.

Neural Correlates of Focused Attention Meditation

Anyone who has tried to follow their breath while sitting quietly has likely noticed that the mind transitions through a number of different phases during the meditation session. When they first sit down and start the session, they make the volitional decision to put their attention on their breathing. At some point in the future the meditator is likely to notice that they are no longer following their breath and that they have been lost in daydreaming or some other form of mental time travel. At that point they will decide

again to focus their attention on their breath and start the process all over again. This is the experience of focused meditation for the vast majority of people who try it.

One interesting study¹³⁵ led by Wendy Hasenkamp at Emory University used brain imaging technology to map these phases to different large scale brain networks. Fourteen experienced meditators spent 20 minutes focusing on sensations of breathing at the nostrils and upper lip. Whenever they realized that their mind had wandered off, they pressed a button and then returned their attention to following their breath. The researchers used each button press to divide the surrounding period into four three-second phases: mind wandering, becoming aware of mind wandering, shifting attention back to the breath, and maintaining focus on the breath. The different phases were associated with different brain networks. During mind wandering, activity was greater in default mode network regions which we have seen is the seat of self-perception. When meditators noticed that their minds had wandered, the salience network became strongly active. This is no surprise as the salience network is in charge of noticing when a goal is not being met and the goal here was to pay attention to the breath. When the meditators shifted attention back to the breath, areas involved with the central executive network came online. During the following three-second period, which the researchers identified as sustained focus, activity was mainly a subset of the central executive network.

Generally, “task positive” network activity that sustains attention includes both executive and top-down attention brain components. However, in this study it was just the executive components. I suspect this was likely due to them only measuring brain activity for the first three seconds of sustained attention. Based on my own experience of meditation, the participants were likely still at least partially reorienting and solidifying their attention during the beginning of that three second window. Other studies¹³⁶ that monitored considerably longer periods of sustained attention showed more of the expected top-down attention regions being recruited.

Neural Correlates of Open Monitoring Meditation

We looked at the study from Emory University where they analyzed the phases of focused attention meditation and determined the neural correlates of each phase. Unfortunately, there is not a similar study that does the

¹³⁵ See (Hasenkamp W. , Wilson-Mendenhall, Duncan, & Barsalou, 2012)

¹³⁶ See (Dickenson, Berkman, Arch, & Lieberman, 2013) and

same thing for open monitoring meditation. I think it's fair to say though that there is similar brain activation during the daydreaming detecting and reorienting phases of the process with both types of meditation. Anecdotally it feels similar and it makes sense from a brain function perspective. Where the techniques diverge is what happens when we return back from the mind wandering state. In focused attention, we return back and reengage with our singular target of attention. By contrast, when we return back from daydream during open monitoring meditation, we don't place our attention on one particular target. Instead, we purposefully open up our attention to a vigilant and receptive state where we can notice any sensory experience or cognitive activity that might arise. This way of being has an open and diffuse attentional stance compared to the narrow and singular one of focused attention meditation.

Despite lacking an open monitoring version of the Emory University meditation phase study, we can fairly easily assemble a model of what the neuro correlates of open meditation likely are. When we start a session of open monitoring meditation, it will be the central executive network that defines the task we are setting out to do and begins the process of being aware. In the next step a large-scale network called the vigilance network is invoked which maintains and monitors the vigilant state¹³⁷. The dorsal attention network, which is a subset of the vigilance network, helps keep attention engaged with what is being sensed so you stay ready to notice what is happening moment by moment¹³⁸. The vigilant state that is produced is open, receptive and diffuse with no one target of meditation. During a period of vigilance there may be moments when the default mode network comes online and starts running its narrative self simulations, the vigilance network can detect this break and invoke vigilance again¹³⁹. The vigilance would continue until it becomes too mentally tiring to maintain or a new task takes precedence.

A group of researchers from Japan conducted an experiment¹⁴⁰ to try and discover what the differences are between focused attention meditation and open monitoring meditation and discovered some fascinating variances. They confirmed that both open monitoring meditation and focused attention meditation reduce connection between the rear part of the default

¹³⁷ (Langner & Eickhoff, 2013) defines a network for vigilance that contains the cingulo-opercular network (similar to the salience network), dorsal attention network, lateral prefrontal cortex, thalamus, and other areas.

¹³⁸ See (Langner & Eickhoff, 2013)

¹³⁹ See (Langner & Eickhoff, 2013)

¹⁴⁰ See (Fujino, Ueda, Mizuhara, Saiki, & Nomura, 2018)

mode network and a brain region known as the striatum. The striatum is linked to reward and incentive salience. This likely is the mechanism that underlies meditation's ability to reduce the "I really want this" feeling that comes with desire. In my mind, their most important discovery was that open monitoring meditation reduced connection between the striatum and the default mode network's autobiographical memory regions. The researchers interpret it as detachment from autobiographical memory. They go on to say that detachment from autobiographical memory may play an important role in non-judgmental and non-reactive states of open monitoring meditation. We have seen how autobiographical memory is one of the core underpinnings of the narrative self. The narrative self can transform our desires into craving, grasping and clinging. Given how we saw earlier that deep states of open monitoring meditation can lead to profound no-self experiences, it seems plausible that this detachment from memory can attenuate the continuous self as well.

Of course, focused attention meditation can lead to attenuation of self as well. A difference between the types of meditation though is that open mindfulness meditation is far more portable. Maintaining a present-moment-focused attentional vigilance is something that can easily be taken with us when we get up from the cushion and into the wider world. This does not mean that open monitoring meditation is inherently better though. There are tradeoffs in terms of the during-meditation benefits of the two approaches. For example, focused attention meditation has been shown to be much more effective at producing the tranquility effects of shamatha¹⁴¹. It reduces pain intensity in a way that open monitoring meditation does not seem to do¹⁴². It also produces more stability in attention¹⁴³. There is also a long-standing belief among many commentators and observers that focused attention meditation is more likely to tee up a sudden awakening experience (kensho)¹⁴⁴. A caveat on that last point however is that it is usually asserted in reference to koan practice which introduces an additional variable to consider. Also, it's worth noting that my first kensho experience came directly after a sesshin retreat where I had been practicing something much closer to open monitoring meditation than focused attention meditation.

One last thing I would like to explore concerning open monitoring meditation is that in discussions of the Soto Zen's meditation technique called *shikantaza*, some people will assert that it "doesn't involve concentration" or

¹⁴¹ See (Ooishi, Fujino, Inoue, Nomura, & Kitagawa, 2021)

¹⁴² See (Zeidan, et al., 2011) and (Gard, et al., 2012)

¹⁴³ See (Swanson, Lin, & Judah, 2026)

¹⁴⁴ See (Schlütter, 2008)

it “does not involve doing anything”. I think it is important to have a nuanced and realistic view of these types of assertions or beginners can get the wrong idea. When it is said that *shikantaza* doesn’t involve concentration, it is important to be clear that it does not involve concentration on one singular target. In the open and receptive awareness of *shikantaza*, we do not concentrate on a target, but we do have active attentional effort to stay vigilant. It has been established earlier that the most important part of practice was the skillful use of attention. Without invoking attention in some way, we do not get the core anti-correlation with the default mode network that is so foundational to the Zen path. Likewise, when it is asserted that *shikantaza* does not involve doing anything, we don’t want to mistakenly give the impression that just letting the default mode network daydream at will can be equated with meditation. Once again, we need to invoke attention. That attention may be a vigilant wide open and receptive attentional stance, but it is still invoked attention.

Koan Meditation Practice

Koans are stories, questions or declarations that are designed to express non-duality. Superficially they may seem like riddles because they often contain what seems like nonsense or non-sequiturs, but that is not really the case. They are coherent once perceived through the perspective of non-duality. Anyone can read a koan and ponder it or discuss it, but “koan practice” has a specific meaning. It is the modality where a teacher assigns a koan to a student and they have to hold it in their mind and then at a subsequent meeting present a response to the teacher of their non-dual understanding of the koan. Koan meditation is somewhat difficult to discuss because to fully explain how it works, I would have to share what would be a valid “answer” for a koan, and that robs people of the ah-ha moment if they hear a possible answer first. I will say though that working on some types of koans can involve leaving our own dualistic conceptualizations and entering or becoming the scene that the koan describes. In a strange sort of way, you become an actor in the inner stage of your mind within the context of the koan. You lose yourself and your dualistic conceptualizations and “become” the koan. The deeper your samadhi, the deeper you can lose yourself in the koan. At least that is how all this works in our lineage with these specific types of koans. I can’t speak for all lineages.

Given that working on one type of koan involves leaving the self and becoming the scenario of the koan, I was curious what the neuroscience of stage acting might be. Actors sometimes describe that acting can become

like a flow state where they lose their sense of self. In a 2019 study¹⁴⁵ from McMaster University in Hamilton, Ontario, researchers used brain imaging to examine what happens in the brain when trained actors temporarily take on the identity of a fictional character. Fifteen actors answered a series of hypothetical questions under several conditions: 1) answering as themselves 2) answering from the perspective of someone they knew well, and 3) answering in character as either Romeo or Juliet. When the actors responded as the fictional character rather than as themselves, overall brain activity decreased, with especially strong reductions in the frontal portions of the default mode network. Some of these default mode network reductions occurred when participants simply took another real person's perspective, which also involves leaving one's own perspective, but acting produced deeper frontal default mode network deactivation which indicates fully inhabiting a character involves more than ordinary perspective-taking. The researchers interpreted the pattern as evidence that acting may involve a temporary suppression or loss of aspects of the ordinary self as the actor adopts the character's point of view. This is especially interesting to me because the actors were not specifically trying to control their attention yet wound up in a meditative state.

I feel that another, perhaps more pervasive, aspect of koan practice is curiosity. To understand what I mean, imagine a Zen teacher assigned you the koan: "Stop the ringing of the distant temple bell". You may wonder, "just how does one stop the rings of a temple bell that is far away?" This inquiry produces a state of curiosity. Perhaps you eventually think, "I know! I cover my ears!". Your Zen teacher would probably point out that this answer reifies "you" and the "bell" as dualistic conceptual objects, so as a result, the answer is way off. Now your sense of curiosity is probably more focused and more sustained. Eventually you find the non-dual perspective you need and pass the koan. But then you are assigned another koan and a curiosity-driven mind state is reignited.

This is one value of going through a koan curriculum. It sustains an inquiry/curiosity "vibe" that, in my opinion, is very helpful to practice. One study¹⁴⁶ on curiosity shows how the salience network becomes active during states of pre-answer curiosity and that the default mode network remains relatively deactivated until an "answer" satiates the curiosity state.

¹⁴⁵ See (Brown, Cockett, & Yuan, 2019)

¹⁴⁶ See (Jepma, Verdonchot, van Steenbergen, Rombouts, & Nieuwenhuis, 2012)

This follows the same patterns of meditation generally and shows how curiosity can be a force-multiplier for practice.

Zen, Embodied Meditation and the Insula

One aspect of meditation that seems to have originated in Chinese Zen is focus on an inner region of the lower torso that can be called the hara, dantian or tanden. You can see references to this location in pre-Buddhist Daoist texts. For example, in the *Baopuzi* (*The Master Who Embraces Simplicity*) which was written in 4th Century China by Daoist alchemist Ge Hong states:

"[The One] is either in the lower dantian, two and four-tenths inches below the navel; or it is in the middle dantian, within the Crimson Palace and Golden Gate below the heart; or it is between the eyebrows—moving inward one inch is the Hall of Light, two inches is the Cavern Chamber, and three inches is the upper dantian."

A couple of centuries later Zhiyi (538–597 CE), the founder of the Tiantai school, wrote the *Xiao Zhiguan* (*The Shorter Treatise on Calming and Contemplation*). This was the first practical, step-by-step meditation manual in Chinese history. Its structure became a template for many subsequent Zen manuals (including those by Zongze and Dogen). In Chapter 4 ("Sitting in Meditation"), Zhiyi outlines various methods for achieving shamatha tranquility and here he states:

"Bind the mind to the center of the navel, to an area the size of a bean, causing the mind to turn inward so it is not allowed to scatter outward."

You can find this type of teaching in many places in Chinese Zen. For example, from the 13th Century Chinese Soto (Caodong) teacher Tiantong Rujing we can find:

"The inhaled breath arrives at the dantian; however, since it comes from nowhere, it is therefore neither long nor short. The exhaled breath leaves from the dantian; however, since it goes nowhere, it is therefore neither short nor long."

One thing these focused attention meditation style instructions all have in common is that they are invitations to focus on a somatic aspect of meditation and any such interoceptive perception involves the salience network's insula brain region. As we will see later, the neuroplastic transformation of the insula is one of the key mechanisms in unlocking persisting practical benefits from meditation. It could be that these types of embodied meditation instructions could increase the rate at which the insula is transformed.

Effortless Meditation

At some point in my practice journey, I started noticing that my need to manually involve and sustain concentration while meditating was becoming less and less required. Often times the concentrated or vigilant states of meditation would seem to have a momentum of their own. Even if my attention was hijacked by the default mode network's narrative self mode, coming back to the present moment would increasingly happen of its own accord with no need for a manual invocation of awareness. I have heard this from other long-time meditators as well.

This phenomenon has actually been documented in meditation studies. One example was a study conducted in 2007 by researchers at the University of Wisconsin–Madison along with their colleagues at the Waisman Laboratory for Brain Imaging and Behavior¹⁴⁷. In this study, the researchers used functional magnetic resonance imaging while novice and highly experienced Buddhist meditators practiced focused-attention meditation which had them concentrating on a small visual object. Experienced meditators with about 19,000 hours of practice (which is a lot) showed greater activity than novices in brain regions involved in sustaining attention. This would represent their ability to sustain attention through top-down attentional control. By contrast, most experienced meditators, with roughly 44,000 hours of practice, actually showed less activity in these same regions. This could be visualized as an inverted-U shaped pattern where attentional control appears to become stronger and more heavily utilized as meditation expertise develops, but after enormous amounts of practice maintaining concentration requires less purposeful effort. The researchers interpreted this as evidence that meditation, much like expertise in other skills, can eventually become more efficient and comparatively effortless rather than requiring continuous deliberate control.

¹⁴⁷ See (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007)

This is our first example of a meditation effect that is not just something that emerges during meditation but is a persistent change that exists well beyond just one meditation session. Whenever this happens it is because something has measurably changed in the structure of functioning in the brain. In the next chapter we will explore some of the many persistent changes that can come about through meditation.

19 - PERSISTENT BENEFITS FROM MEDITATION (JORIKI)

One of the perennial debates in Zen is whether the mind transformations of Zen are accomplished gradually or suddenly. One illustration of this debate is the apocryphal story of the 6th Zen ancestor in China, Huineng. The story revolves around the selection of a successor to the 5th Zen ancestor in China. In order to help determine who the successor should be, the 5th Zen ancestor called for his students to submit a poem that illuminated their understanding of Zen. One student submitted his poem as graffiti on a wall of a monastery that read:

*The body is the bodhi tree.
The mind is like a bright mirror's stand.
At all times we must strive to polish it
and must not let dust collect*

Huineng, who was another student at the monastery, responded with his own graffiti poem:

*Bodhi originally has no tree.
The bright mirror also has no stand.
Fundamentally there is not a single thing.
Where could dust arise?*

With this poem, Huineng wins the contest and becomes the 6th Ancestor. His poem was selected because the first one only showed the activity of gradual cultivation represented by polishing the mirror. The winning poem represented seeing reality through the lens of emptiness in which there is nothing that needs to be cleaned.

While it is certainly true that the ultimate goal of Zen is indeed seeing that “there is no mirror”, more than one modern Zen teacher has pointed

out that to get to that point, you first have to spend a lot of time polishing that imaginary mirror. An important point to recognize regarding this mirror polishing is that even aside from it helping set the conditions for awakening, there are immense benefits to human life that result from Buddhist practice that emerge well before awakening.

Pre-awakening benefits are well attested to in the Early Buddhist texts. One of the teachings that are frequently found in these texts is the concept of the seven awakening factors. The seven awakening factors are the mental qualities or factors that improve our chances for awakening. In the *Bojjhaṅgadesanā Sutta* (“A Teaching on the Awakening Factors Discourse” - SN 46.22) the Buddha lists these factors:

And what are the seven awakening factors? The awakening factors of mindfulness, investigation of principles, energy, rapture, tranquility, immersion, and equanimity. These are the seven awakening factors.”

These are factors that increase the chances someone will awaken to the nature of true reality but are also very appealing goals in themselves regardless of their utility of priming the mind for awakening. Tranquility and equanimity especially stand out. In the *Upekkhā Sutta* (“Equanimity Discourse” - 46.65) the Buddha explicitly agrees in the case of equanimity:

Mendicants, when equanimity is developed and cultivated it's very fruitful and beneficial.

These examples illustrate a belief that existed from the earliest days of Buddhism: even before awakening, while we are still “gradually cultivating”, there can be immense benefits from the path. For some people, it can be very motivating and inspiring that these pre-awakening benefits can be both explained and quantified by neuroscience and psychological science and that is largely the goal of this chapter. We survey a few of the wholesome changes that can occur in our lives due to dedicated Zen practice.

Traits vs States

In meditation research there is often a distinction made between states and traits. A state in this context is a temporary condition of the brain or the mind that can change from moment to moment depending on what a person is doing or experiencing in meditation. A trait is a lasting characteristic

that persists across meditation sessions. For example, if someone meditates for twenty minutes and shows reduced activity in brain regions associated with mind-wandering during that session but only while meditating, that would be a state effect of meditation. By contrast, if repeated meditation practice produces changes that persist and are measurable or reportable when a person is not meditating then it is a trait. An example might be that a person just organically experiences less mind wandering in their day-to-day life after a few months or years of meditation. Neuroscience studies can experimentally change a person's brain state by having them perform different tasks, while trait research looks for stable differences that continue across varying conditions and repeated measurements.

Neuroplasticity

There is a saying in neuroscience that goes, “Neurons that fire together, wire together”. It basically means that the functional patterns in the brain can actually change the brain. The formal name for this phenomenon is neuroplasticity. Neuroplasticity is the brain's ability to change its structure and function based on neural activity. These changes can be in response to experience, learning and repeated use. A famous example comes from studies of London taxi drivers, who must memorize an extraordinarily detailed map of the city as part of their job. Researchers found that experienced taxi drivers had structural differences in the hippocampus which is a brain region that supports memory and navigation¹⁴⁸. Further evidence was found in a later study followed by people that while they trained to become taxi drivers and found that those who successfully learned the city maps developed increased gray-matter volume in the posterior hippocampus, while people who failed to qualify as taxi drivers showed no such change¹⁴⁹. This illustrates a fundamental principle of neuroplasticity which is that repeatedly using particular brain systems can physically alter them. These changes are made because it allows the brain to be better adapted to scenarios and challenges that it will likely have to face again and again. Neuroplasticity is the physical alteration of complex cell networks, changes in how cells function or a change in how cell networks talk to each other.

Many of the neuroplastic changes in the brain are the result of alterations in how neurons connect and communicate with one another. When particular groups of neurons are repeatedly active together, the connections

¹⁴⁸ See (Maguire et al., 2000)

¹⁴⁹ See (Woollett & Maguire, 2011)

between them can become stronger and more efficient and connections that are used less often can weaken. The brain can also grow new synaptic connections, reshape the small branches that receive signals from other neurons, and reorganize which neural pathways are most strongly recruited for a particular need. Over time, these cellular changes can produce measurable changes in the physical structure of a brain region. Researchers can sometimes detect this as an increase in gray matter volume or cortical thickness.

With repeated activity, the brain can also change the sheathing (myelin) that surrounds some of the wiring (axons) between cells. This allows signals to travel through frequently used pathways more quickly and with more precise timing. Researchers can sometimes detect wiring alterations as differences in white matter which is the tissue that consists mostly of wiring that connects different parts of the brain. Such changes can improve various factors of communication such as speed, timing, reliability, and synchronization of the signals that travel through the connections. Well-connected brain regions coordinate their activity more effectively. Together, these forms of neuroplasticity can make frequently practiced patterns of thought, perception, learning or action easier. This makes these cognitive activities more stable and effortless over time.

In some cases, neuroplasticity can also develop through lasting changes to the properties of existing neurons, even without new wiring between them. With repeated use, individual neurons in a network can become more excitable and more likely to activate when participating in the network. Over time, the network can participate in the activity more reliably and with less effort. Those lasting physical changes can alter how strongly the involved regions co-activate.

One way that neuroplastic changes in the brain's wiring or more excitable networks can alter brain function is by producing lasting changes in functional connectivity between brain regions. Functional connectivity denotes how strongly and consistently different brain regions coordinate their activity with one another. When the neural activity in one brain region is correlated or anti-correlated with the neural activity in another, you can say they are functionally connected. The magnitude and timing of the correlation or anti-correlation can be part of what goes into determining how connected two regions are. For example, mindfulness training has been found to increase functional connectivity between the amygdala and ventromedial prefrontal cortex while people viewed emotional images. This change was

interpreted by the researchers as a possible mechanism for improved regulation of emotional responses¹⁵⁰.

Short-term Practice Benefits

In this section we will look at the neuroplastic benefits that emerge from people engaging in short-term training. Typically, these studies are built around programs like Mindfulness Based Stress Reduction (MBSR) or something similar in length and content. The standard curriculum for the MBSR program consists of eight weekly 2.5-hours sessions, an all-day practice session and daily home practice. This level of practice is probably comparable to someone who starts practicing at a Zen center for two months and then attends their first one-day retreat (zazenkai). The meditation in these programs is usually a mix of styles but predominantly breath focused which is the style of meditation that most new Zen students would be assigned.

One thing to consider about studies based around Mindfulness Based Stress Reduction is that meditation is not the only variable that is changing for the participants. They are also participating in a social setting and receive instruction from an instructor who is focused on the group. As a result, these studies should not be considered a test of meditation alone but what can be possible when someone starts meditating in a social group under the tutelage of an instructor. In Zen, many students take refuge in Buddha (the teacher), Dharma (the teachings) and Sangha (the community) and these programs encapsulate that experience nicely.

Trait Mindfulness

At its core, trait mindfulness is the capacity for a person to be attentive to and aware of what is happening in the present moment not just during meditation but also when they are off the cushion and engaged with daily life¹⁵¹. It is a measure of how often we are aware of what is happening “right now”

¹⁵⁰ See (Kral, et al., 2018)

¹⁵¹ Some modern definitions of mindfulness include “symptoms” of present-moment-awareness such as nonjudgment, acceptance, nonreactivity, observing emotions, or decentering. Here our operational definition will be more about the present-moment-awareness itself, and we will carve out the “symptoms” separately.

as opposed to having our mind hijacked by self-referential and time-traveling thinking. You will also see this as labeled as “dispositional mindfulness” in some research papers. We have seen repeatedly in this book how important it is to be able to control attention and attend to the present moment and dispositional mindfulness measures how often or easily someone is likely to do this.

One study¹⁵² that looked at how much trait mindfulness was acquired by participants during an eight-week mindfulness program. They randomly assigned 44 college students to either an eight-week Mindfulness Based Stress Reduction (MBSR) course or an eight-week meditation program called the Eight Point Program, or a control group that was on the waitlist to attend a mindfulness program. They measured mindfulness before training, immediately afterward, and again eight weeks later using something called the Mindful Attention Awareness Scale. It is a survey that assesses how consistently people tend to pay attention to and remain aware of their present-moment experience in everyday life. Compared with the waitlist group, participants in both meditation programs showed significant increases in this everyday tendency toward mindful awareness. In fact, the effect was actually larger at a follow-up interview eight weeks after the program than immediately after the courses. These results strongly suggest that the meditation training had produced an enduring capacity to be mindful outside of formal meditation rather than merely a temporary state experienced while actively meditating.

People suffer when they get locked into uncontrolled and unproductive spirals of negative thinking and mental time travel. Increasing our capacity to be in a mindful state of being that counteracts this grasping and suffering can greatly improve our well-being.

Perceived Reduction in Stress

Given that the Mindfulness Based Stress Reduction program has “stress” in its name, it should come as no surprise that stress reduction is a commonly studied trait benefit of meditation training. There is lots of evidence that short term meditation makes people feel like they are less stressed. As an example, one study¹⁵³ showed that compared with the control group, the participants who received the training showed substantially greater reductions in perceived stress and feelings of exhaustion. They also reported

¹⁵² See (Shapiro, Oman, Thoresen, Plante, & Flinders, 2008)

¹⁵³ See (Nykliček & Kuijpers, 2008)

increases in positive mood, quality of life and mindfulness. The researchers found that the degree of trait mindfulness one experienced tended to correlate with improvements in reduction in stress and improvements in quality of life.

This makes sense in light of what we have explored earlier in this book. We saw in the Aversion (Dvesa/Zeng) chapter that our capacity for an acute fear response can degenerate into chronic stress when both the cognitive and chemical safety systems that put the brakes on fear in the brain malfunction simultaneously. In a healthy scenario, ending a fear response requires an "all clear" signal from analytically minded frontal cortex after it cognitively assesses that a threat has passed. The brain will also cease the emission of stress hormones when there is no longer any danger. Unfortunately, this system has the potential to break down during chronic periods of repeated fear responses when there is not a chance to reset emotionally. Chronic fear responses can release so much cortisol that it begins to impair the prefrontal cortex which can cause this rationally thinking part of the brain to go "offline". When this happens, it removes the one thing that can reappraise a situation and determine that a threat is no longer in existence. This leads to a downward spiral of chronic stress.

Trait mindfulness can help reduce stress in more than one way. The first way that trait mindfulness can help is that it can prevent short-term fear from turning into chronic stress by making people less likely to keep interpreting a difficult situation as an ongoing threat. We have seen how powerfully mindfulness can short-circuit this type of repetitive negative thinking and this can keep fear responses from escalating to chronic stress in the first place. After a dangerous event has passed, mindfulness can help us spend less time ruminating about it. As long as our mind continues to ruminate about the situation, we are basically telling the brain something is still wrong and that can extend the stress response. Research¹⁵⁴ also suggests that greater dispositional mindfulness is associated with better regulation of emotional responses by the prefrontal cortex which helps with the generation and reception of an "all clear" signal.

Reduced Anxiety

While stress is a pervasion of the fear response for perceived danger that is currently relevant, anxiety is more centered around repetitive and uncontrolled concern about the future. There are many studies that show that trait

¹⁵⁴ See (Creswell, Way, Eisenberger, & Lieberman, 2007)

mindfulness can reduce the symptoms of anxiety. One study¹⁵⁵ showed that participants who became less automatically reactive to distressing thoughts, emotions, and bodily sensations tended to show greater reductions in anxiety symptoms at a post program one month assessment. The researchers suggested that trait mindfulness may reduce anxiety not primarily by preventing anxious thoughts or feelings and bodily sensations from arising, but by weakening the reactions to them.

These results point to the mechanisms by which our cognitive reactions to unmet expectations do not necessarily need to escalate into a sustained session of worry-fueled grasping. When the salience network is cued to recognize a potential problem in fulfilling a desired goal, other brain networks like the central executive network and the default mode network will spin up to analyze the situation. The default mode network will activate its narrative self mode to run simulations to envision a path forward towards the goal and estimate how bad the consequences will be if the goal is not met. If goal attainment is too uncertain and the consequences are significant enough, the brain may cause us to revisit this over and over again until a solution is found. This repetitive negative thinking is the sustained grasping that causes us to suffer. What the study is likely showing is that after the initial “prediction error” recognition, there would be initial anxious thoughts or feelings and bodily sensations. If someone possesses sufficient trait mindfulness, they will have the ability to keep this from escalating to a full-blown repetitive grasping session.

Reduced Depressive Symptoms

Depression is a persistent state of sadness, low energy, and a loss of interest in life. It is often associated with a ruminative form of repetitive negative thinking. Meditation training has been shown to be an effective approach for lowering depressive symptoms in a number of experiments. A study¹⁵⁶ that followed meditators over the course of a meditation training program showed that trait mindfulness increased while depressive symptoms decreased. Participants who showed larger increases in trait mindfulness also tended to show greater reductions in depression. Another study¹⁵⁷ showed that greater mindfulness was associated with reduced rumination, which in turn then predicted fewer depressive symptoms. It also provided evidence

¹⁵⁵ See (Zainal & Newman)

¹⁵⁶ See (Greeson, et al., 2015)

¹⁵⁷ See (Jury & Jose, 2019)

that the changes occurred in a predicted order of more trait mindfulness, less rumination and then less depressive symptoms.

The Neuroplastic Transformation of Mindfulness in Short Term Meditators

A central mechanism runs through the outcomes of reduced stress, reduced anxiety and reduced depression. The factor that is common through all of them at this level of meditation experience is a person's capacity for being attentive to and aware of what is happening in the present moment in a dispositional manner. The easier or more habitual it is to deploy a present-focused state of mind, the less they will suffer in their daily life from stress, anxiety and depression. It is remarkable that this is accessible to people with only a few months of meditation training. Generally speaking, trait mindfulness leads to a general improvement in quality of life and psychological well-being¹⁵⁸. Improving our capacity to stay present can measurably improve our lives.

Like we did in the mindfulness chapter, it is worth pointing out that the wholesome qualities that have been identified here that result from practice have nothing to do with adopting any new philosophies or gaining any psychological insights. These changes do not come from a new way of thinking; they come from a change in the manner in which we interact with thinking itself. Our lives are improved from a transformation of our attentional relationship to the thoughts and feelings that come into and out of awareness. By simply having more ongoing control of our attention, our lives begin to transform.

Long-term Practice Transformations

At the "long term meditator" level, physical and structural neuroplastic changes in the brain become more pronounced and they can become identifiable in brain scan images. Deeper and more transformational changes are possible when someone sticks with the practices and starts accumulating lifetime meditation measured in the thousands of hours. Somewhere around 1500 lifetime hours seems to be the threshold where deeper and more transformational neuroplastic results begin to emerge. The trait level changes at the "long term meditator" level are often "dose dependent"

¹⁵⁸ See (Nyklíček & Kuijpers, 2008)

meaning that they can become more pronounced as lifetime meditation hours increase.

The Physical Transformation of the Brain in Long Term Meditators

At the “long term meditator” level, physical and structural neuroplastic changes in the brain become more pronounced and can become identifiable in brain scan images. If we wanted to summarize it, we could say: meditation makes the insula more effective. Part of what makes it more effective is that it actually gains gray matter and becomes bigger. This is shown in a meta-study¹⁵⁹ that reviewed 25 structural magnetic resonance imaging studies, involving about 1,400 unique participants. It sought to determine whether meditation is associated with consistent changes in the brain’s gray matter. Although individual studies had reported wildly differing brain regions where gray matter was increased, the researchers found that only one location showed reliable increases across all of the studies and this region was the right anterior ventral insula. This is a key node in the salience network which is tasked with body state interoception and switching other brain networks on and off based on salient events in the body or outside world.

The Functional Transformation of the Brain in Long Term Meditators

A description of the functional transformations of the brain that come from long term meditation should show how large-scale brain networks change connectivity with themselves and how they connect to other large-scale brain networks. One meta study¹⁶⁰ sought to determine this. They looked at trends from 10 separate imaging papers to see what functional transformation might come from meditation. Their results suggested that as meditation experience increases, regions within the default mode network become somewhat less tightly coupled with one another, while connections between default-mode regions and brain systems involved in attention and cognitive control become more robust. The researchers thought that connectivity changes within the default mode network corresponded to less mind-wandering, self-referential thought, and rumination. They felt that

¹⁵⁹ See (Pernet, Belov, Delorme, & Zammit, 2021)

¹⁶⁰ See (Shen, Zhou, Chen, Castellanos, & Yan, 2020)

connectivity changes between the default mode network and other large scale brain network corresponded to greater awareness and regulation of thoughts as they arise.

Pain Regulation in Long Term Meditators

I think at some point most long-term meditators get to the point where they notice there is disassociation between physical pain and the suffering that results from it. For many people this may sound nonsensical but there is a good chance that a long-term meditator would find this self-evident. This is the experiential validation of the teachings in the *Salla Sutta* ("*Two Arrows Discourse*" - SN 36.6). I had personally experienced this through knee pain at various retreats, but I experienced it in a truly profound manner at one retreat I attended that was being led by Joko Beck who was the author of a famous Zen book entitled *Everyday Zen*. She was the teacher of the teacher I was working with at the time. At that time, I had romantic interest in someone who was kind of hot and cold towards me. We would sort of date and then she would pull away. The problem was that I was wildly infatuated with her, and her mixed signals just seemed to make it worse. I was getting more and more tired of the situation and told her I needed a break. But then right before driving down to my retreat I had some separation anxiety and sent an email that maybe we could hang out right before I got back and then drove down from Oakland to San Diego.

This was in the days before cell phones so the next day I went to a library near the San Diego Zen Center to see if she had responded. Indeed, she had and in a rather unfriendly manner said she didn't think we should have any more contact. To say I was crushed would be an understatement. Even though I was in my 20s, this was my first broken heart, and I felt worse than I had ever felt in my life. I feel a bit overdramatic saying this now, but at the time I was not sure how I would be able to cope with the pain. I strongly considered bailing on the retreat but decided at the last minute to attend. I remember the first zazen session was just torture. Not being able to engage in some sort of escapism to hide from the pain was incredibly difficult. At some point in the retreat, I think it may have been the morning of the second day, it became experientially obvious to me that if I tried to head into the pain, it got worse and if I tried to not feel the pain it got worse. But if I just did nothing and simply stayed present, almost immediately there would be just pain and no added suffering. The pain did not even register as aversive; it was just energy. Since I was not running from pain anymore it seemed like my body resolved it very quickly and by the end of the retreat, I was

not feeling a broken heart at all and felt completely over her. It was like a miracle. I strongly suspect it would have taken me months to get over her if I had not been forced to face it head on in a multi-day retreat.

A study¹⁶¹ in 2011 from the Université de Montréal looked to discover what the neuro correlates of pain regulation in Zen meditators might be. They scanned the brains of experienced Zen meditators to see how they responded to painful heat and then did the same with nonmeditators. What they discovered was that rather than simply having dampened pain signals, the Zen meditators actually showed stronger activation in regions directly involved in registering pain. At the same time, they showed less activation in areas involved in conceptualizing, interpreting, and emotionally reacting to the pain¹⁶². In other words, they likely were not launching into narratives about how they wish that it was not happening. The default mode network was likely not being activated enough to invoke its suffering circuit.

Resilience in Long Term Meditators

Resilience is defined differently in different contexts but the definition that matters most to us here is this neuroscience oriented one: Resilience is the speed of recovery from a negative or stressful event, meaning how quickly the emotional and physiological response returns to baseline once the provocation has passed. Often this is measured by quantifiable stress readings because they are so easy to read and quantify. In my own life, I have noticed resiliency in areas other than just stress. For example, if I am sad or angry, I tend to bounce back quite quickly for those as well. A 2019 study¹⁶³ found that compared to controls, long term meditators had cortisol levels returned toward baseline more rapidly after the stressful event was over. This shows a faster physiological recovery from the stressful situation. They also reported greater acceptance and positive reappraisal with less catastrophizing and shame. This last finding probably can be thought of as the meditators engaging in less rumination and general dualistic conceptualization. It seems reasonable that this could be a contributor

¹⁶¹ See (Grant, Courtemanche, & Rainville, 2011)

¹⁶² prefrontal cortex, amygdala, and hippocampus

¹⁶³ See (Golesorkhi, Gomez-Pilar, Tumati, Fraser, & Northoff, 2021)

Equanimity in Long Term Meditators

A good definition of equanimity we will use is that it is a state of internal balance, in which there is no suppression, nor grasping toward internal or external sensory experiences. It does not matter if the sensory experiences are pleasant, neutral or aversive. In all cases, habitual response to them is reduced. I have definitely noticed an increase trait in my own life. While I still certainly have my moments of unintended automatic reactions to what I experience in life, overall, I find I have considerably more capacity to pause and not immediately get caught up in habitual thinking and reaction. It makes life a lot easier for myself and those around me.

In a study¹⁶⁴ out of the Harvard Medical School, researchers reviewed papers on highly experienced meditators and identified equanimity as one of the most consistently referenced benefits associated with long-term practice. Across pleasant and unpleasant events, experienced meditators tended to show less distress and emotional volatility. They were also less likely to ruminate, worry or overthink in response to events. The authors describe the mechanism as a partial decoupling of sensory experience from the emotional and evaluative reactions that usually follow it. They suggest that meditation may not eliminate negative or positive feeling but rather weaken the automatic pull to resist, pursue, or become absorbed in it.

Permanence of Neuroplastic Brain Changes

An interesting question we can have about neuroplastic brain changes is how permanent they might be if we stop meditation practice. Are they persistent? Are they ephemeral? Unfortunately, I don't know of any such studies for long term meditators but there was a study that checked in on participants of an eight-week Mindfulness-Based Stress Reduction course a little over five months after the program ended. Participants and controls had their brains scanned before and then after the program and then at the check in. After the mindfulness course, participants showed stronger resting communication between the posterior cingulate cortex, a major hub of the default mode network, and the dorsolateral prefrontal cortex, which contributes to attention and cognitive control. This increase was also associated with better self-reported attention. At the check-in, only those who continued meditating still had the increased connectivity between brain regions.

¹⁶⁴ See (Ehmann, et al., 2025)

20 - A LIBERATED MIND (NIRVANA)

“Nirvana” is a Sanskrit word that means “extinguishment” or “to blow out” or “blown out”. It extinguishes the causes of suffering. The legendary tale of Zen’s beginnings singles out this nirvana as that which is transmitted from teacher to student in the Zen lineage:

The First Patriarch was the Venerable Mahākāśyapa. On one occasion, the World-Honored One held up a flower and blinked his eyes. Mahākāśyapa broke into a slight smile. The World-Honored One said, “I have the Treasury of the Eye of the True Dharma, the Wondrous Mind of Nirvāṇa. I entrust it to Mahākāśyapa.”¹⁶⁵

In this chapter we are going to explore Mahākāśyapa’s “Wondrous Mind of Nirvāṇa” and investigate what we might be able to say about it from a scientific perspective. In Buddhism, nirvana is what allows one to escape the repeated cycle of birth and death, but it also eliminates suffering in the current life as well. In this chapter we will look at different facets of how and why nirvana eliminates suffering and then in the next chapter we will explore the mechanisms of awakening to nirvana.

The Timeless Mind of Nirvana

As we begin our journey to get some sense of what nirvana might be, let’s first look at the *Paṭhamanibbānapaṭisaṃyutta Sutta* (“The First Discourse Connected with Nirvana” - Ud 8.1):

¹⁶⁵ Soto Zen Master Keizan Jōkin’s book “Transmission of Light”

"There is, monks, that sphere where there is neither earth, nor water, nor fire, nor wind; neither the sphere of infinite space, nor the sphere of infinite consciousness, nor the sphere of nothingness, nor the sphere of neither-perception-nor-non-perception; neither this world, nor another world, nor both moon and sun.

"There, monks, I say there is neither coming, nor going, nor remaining; neither passing away nor arising. It is without foundation, without continuation, and without an object.

"Just this is the end of suffering."

The Buddha here is referencing something called a sphere (*ayatana*). Besides sphere, *ayatana* can be translated as "experiential context", "support", "base", "range" and "field". We will use "experiential context". The sutta can be seen as expressing the idea that nirvana is an experiential context that is timeless and where neither objects nor mind-states exist as mental representations. I use the description "timeless" because there is not neither coming nor remaining, there is neither arising or passing away and there is no continuing. There is no time-based existence. Within the context of nirvana there is none of the normal cognition of the external or internal world that we would normally experience. This sutta excerpt ends with the statement that this experiential context is the end of suffering.

Let's look next at the Nibbāna Sutta ("Nirvana Discourse" - Ud 8.3) says about nirvana:

"Monks, there is the unborn, the unoriginated, the unmade, and the unconditioned. If, monks, there were not this unborn, unoriginated, unmade, and unconditioned, then no escape would be discernible here for what is born, originated, made, and conditioned. But precisely because there is an unborn, an unoriginated, an unmade, and an unconditioned, therefore an escape is discernible for what is born, originated, made, and conditioned."

One way that something can be unborn is if it is never created as an existing entity at some point on a timeline. Another way something can be unborn is if there is no timeline to begin with. Ud 8.1 described nirvana as "without an object". To understand what this might mean in terms of

timelessness, we can revisit the idea that was explored in the Own-Being (Svabhava) chapter about how “an object” gains its quality of own-being in our awareness when it is conceptualized by our default mode network. This conceptualization revolves around time-traveling predictions of the self-referential importance of the object being thought about. In this way, time is fundamentally tied to the graspable own-being nature of an object’s mental representation. If a state of perception is without a basis in time, then there is no object permanence that is subject to dualistic conceptualization and grasping. Within this experiential context of nirvana there is none of this arising or passing away so phenomena is unborn and unconditioned.

The implication of this timeless experiential context of nirvana is found in the *Ajāta Sutta* (“*The Unborn Discourse*”- It 43):

*“Its escape is peaceful,
beyond the reach of reasoning, stable;
unborn, unarisen,
a sorrowless, stainless state.
It is the cessation of things subject to suffering,
the stilling of conditioned activities,
bliss.”*

The “cessation of things subject to suffering” would be the lack of perceived conceptual own-being of objects and phenomena due to the timeless nature of nirvana. The own-being identity would be “unborn”. Without the cognizing of entities to grasp at by a default mode network, there can be no suffering. The result of this, according to the sutta, is peaceful bliss.

To make these ideas concrete, imagine you are in a relationship that is ending. From a dualistic and conventional perspective, “the relationship” can be conceptualized in a time traveling manner that makes it graspable and this subject to suffering. Within a normal cognitive context, we would memories of the relationship that give it self-referential importance. We would also imagine a future in which it provides us with feeling-tone rewards. A simulated future without this relationship that we have deep attachments can be predicted to be extremely painful. This prediction of pain can lead to significant grasping and suffering. However, within the timeless mind of nirvana, there is no such dualistic grasping. Past and future don’t do not bind our thinking. Chinese Zen master Huangbo Xiyun is quoted as saying in the *Essentials of the Transmission of Mind*:

“The true mind is formless, neither going nor coming. At birth its nature does not come; at death its nature does not

depart. Serene in the complete stillness of nirvana, mind and circumstances are one. If you can awaken directly to this, you are no longer bound by past, present, and future and are a person who has gone beyond the world."

The Cessation of Suffering

One consistent theme in Buddhism is that the best way to permanently end the inevitable pain of existence is to stop being reborn into a realm where pain is possible and this is a stated goal of the path. That certainly makes sense, but since we are focusing more on a naturalistic view of Zen Buddhism, we are more interested in how nirvana leads to the cessation of suffering in this lifetime.

To explore this we can turn to the aptly named *Sanditṭhikanibbāna Sutta* ("The Discourse on Nirvana in this Very Life" - AN 3.55):

"When a person is impassioned with lust, overcome by hatred, or confused by delusion, and their mind is consumed by it, they intend harm for themselves, harm for others, and harm for both, and they experience mental suffering and grief.

When lust, hatred, and delusion have been entirely abandoned, they do not intend harm for themselves, harm for others, or harm for both, and they do not experience mental suffering and grief. It is in this exact way, brahmin, that nirvana is visible in this very life, immediately effective, inviting one to come and see, applicable, and to be personally experienced by the wise.

This is quite unambiguous and straightforward. Nirvana is not just about ending suffering by ending rebirth, it is the cessation of suffering in this very life as well. That said, we should be careful not to assume that an awakened person experiences no pain at all though. They very much can and this is described in the *Indriyabhāvanā Sutta* ("The Development of the Faculties Discourse" – MN 152):

"And how, Ānanda, does one exist as a noble one (awakened person) with developed faculties?

When an [awakened] monk sees a form with the eye, there arises in him what is agreeable, what is disagreeable, and what is both agreeable and disagreeable. ...

When he hears a sound with the ear, smells an odor with the nose, tastes a flavor with the tongue, touches a tangible with the body, or cognizes a mental object with the mind, there arises in him what is agreeable, what is disagreeable, and what is both agreeable and disagreeable."

Nirvana does not remove our vedana feeling tone capacity to feel pleasant or unpleasant sensations. Both pleasure and pain are still very much possible. In fact, all five aggregates are said to remain fully functioning after awakening¹⁶⁶. We can still perceive objects in the world, categorize them and then make decisions on how to interact with them. The only difference is that we don't grasp at our five aggregates or grasp at the desires that they produce. One interesting point to consider at this juncture is that if a fully awakened person can feel physical pain, can they feel mental pain at all? After all, if we think back to the sutta about the two arrows it made it clear that the first arrow was physical pain and it was felt by normal and awakened people alike, but the second arrow, emotional pain, was only felt by normal people. It misses someone who awakened altogether. There is another sutta that describes how when the Buddha died all of the non-awakened monks cried but none of the awakened ones did. These awakened beings thought, "Impermanent are conditioned things. How could it be otherwise? The message bring taught here that is that a truly awakened person does not experience such afflictive emotions.

In contrast to this claim there is some evidence that awakened beings do feel mental aversive reactions. Here are some examples where the Buddha seemed to be experiencing negative mental feelings:

- "Seeing this drawback in the demonstration of psychic power, I am horrified, repelled, and disgusted by it." (dn11:5.7).
- "I am disgusted by misconduct of body, speech, and mind, and by the attainment of the many kinds of unskillful things. In this sense you could rightly say that I am disgusted." (an8.11:7.4–7.5)
- "Crowded, I live in discomfort, not at ease." (ud4.5:1.7)

¹⁶⁶ See SN 22.48 Khandha Sutta

- “And if I were to teach the Dhamma, and others were not to understand me, that would be wearisome for me, that would be troublesome for me.” (SN 6.1)

It would seem that he did have the capacity for mentally aversive feelings. I think perhaps instead of being a contradiction in the teachings, it shows a distinction between mentally derived aversive feeling-tones and self-referentially elaborated emotional reaction. Remember that we just established that an awakened person is able to feel aversive feeling-tones through the six senses. Well, one of those senses is the “mind base”. Things that pass through the mind can cause negative feeling-tones prior to the self-referential analysis that causes actual suffering. The mechanisms behind negative feeling-tones is shown in the *Chachakka Sutta* (“Six of Six Discourse” - MN 148):

“Dependent on the mind and mental phenomena, differentiating awareness of mental activity arises. The meeting of the three is contact. With contact as condition there arises a feeling experienced as pleasant, painful, or neither-painful-nor-pleasant.”

At the stage in the cognitive process detailed in that excerpt, there can be an unpleasant feel-tone sensation that emerge from subconsciously generated thoughts or imagery that floats unbidden up into awareness. To be precise about definitions, this is not emotional suffering. For it turn into suffering there first needs to be further cognitive activity that leads to conceptualization. These mechanisms are described in the *Madhupīṇḍika Sutta* (“Honey Ball Discourse” - MN 18):

“What one feels, one perceives. What one perceives, one thinks about. What one thinks about, one dualistically conceptualizes. Based on what one has conceptualized, the perceptions and concepts born of conceptualization beset that person regarding mental phenomena cognizable by the mind, whether past, future, or present.”

At that point, the default mode networks narrative self has gotten involved to run self-referential simulations to determine possible outcomes and what the emotional consequences might be. That is when the possibility of suffering emerges.

The overall process that we just described actually maps quite well to what neuroscientists have discovered about how the brain processes

encounters and generates both initial feeling-tone reactions and then later the self-referential elaborations that can lead to emotional suffering. In a 2018 study, researchers from Southeast University in Nanjing China investigated how quickly the brain responds to signs of social rejection by studying 15 university freshmen who had recently participated in a real club-recruitment interview. Two days after the interview, and before the students knew if they were accepted into the club or not, the students had their brain activity recorded when they were shown photographs of the club interviewers either looking at or away from the students. The assumption was that the students eager for inclusion in the club would be alert for salient clues of their fate and would interpret the photos of the interviewers looking away as evidence against their acceptance. Participants reported feeling much more distressed and excluded when they saw images of an interviewer look away.

The brain scan showed that there were two phases of cognitive response to the distressing photos. The first phase happened after 170–270 milliseconds and the second one at 370–700 milliseconds. The first phase was associated with how distressed the person felt and the second was associated with how strongly the person interpreted the gaze as social rejection. This evidence supports the idea that the human brain can quickly initiate aversive mental feeling tones before a secondary phase of the initiation of full self-referential processing. In other words, even if someone was fully awakened and there would not be any elaborated self-referential analysis that could snowball into sustained emotional suffering, there is still that initial aversive negative feeling tone that preceded full narrative self-engagement.

Let's now revisit the story where the non-awakened monks had dramatic emotional reactions to the Buddha's passing and the awakened ones did not. Keeping in mind what we just covered, it's well within the realm of possibility that upon hearing of the Buddha's passing that the awakened monks could have felt aversive mind states through the mind-base sense yet not have experienced self-referentially driven emotional suffering.

Cessation of Greed, Hate and Delusion

One of the core definitions of nirvana is that it represents the extinguishment of greed, hate and delusion which in the Mahayana tradition are known as the Three Poisons. Greed and hate are emotional elaborations of the cravings for pleasure and cravings to avoid aversive experiences. In the Early Buddhist texts, delusion is often defined as ignorance of the four noble truths and other such formulations but that is not really a satisfying answer

from a Zen practitioner perspective. Mahayana defines it as perceiving objects as real. Zen defines it as not seeing our true nature. Greed, hatred and delusion are targets for extinguishment because they cause us to suffer. The *Akusalamūla Sutta* (“Discourse on the Roots of the Unskillful” – AN 3.69) directly establishes the experiences of greed and hate as a source of suffering:

“Monks, such a person, overcome by unwholesome, unskillful states born from greed, their mind consumed by them, dwells in suffering here in this very life, with distress, anguish, and burning.

[The same is said of states] born from hatred ... born from delusion.”

The *Aññatarabrāhmaṇa Sutta* (“Discourse to a Certain Brahmin” – AN 3.53”) shows how greed hate and delusion can harm ourselves and harm other people:

“A person inflamed by greed, overcome by greed with their mind consumed by it, intends harm to themselves, intends harm to another, and intends harm to both; and they experience mental suffering and unhappiness.

...

A person filled with hatred, overcome by hatred, with their mind consumed by it, intends harm to themselves, intends harm to another, and intends harm to both; and they experience mental suffering and unhappiness.

...

A person who is deluded, overcome by delusion, with their mind consumed by it, intends harm to themselves, intends harm to another, and intends harm to both; and they experience mental suffering and unhappiness.

In Zen, the experience of “greed” and “hate” is often rendered as aversion and attachment. You can find this formulation in the famous Chinese Zen poem *Xinxin Ming* (“Faith in Mind”):

*The Ultimate Way is not difficult;
It is only hindered by choosing and selecting.
Just do not have aversion or attachment;
And it will be thoroughly clear and manifest.
The slightest difference (duality),*

[Creates a separation] as vast as Heaven and Earth.

The grasping of aversion and attachment are states of mind that come from the dualistic conceptualizations default mode network. We saw in the Aversion (Dvesa/Zeng) chapter that the Chinese Zen master and scholar Zongmi explained that when we are fooled by the illusion that the objects and phenomenon that we perceive have individual existence, then we are apt to grasp at them. We have seen that, from a practical perspective, the activity that fuels ongoing grasping is repetitive negative thinking. Rumination for aversion and worry for attachment. When we are caught in these unproductive loops that our attention becomes stuck on, each iteration causes us to relive the prediction error (unmet expectation or goal) and this causes the ongoing fuel of suffering. Each relived moment of the prediction error is a fresh “oh no!” within the default mode network and the circuits that cause emotional pain are activated. The “delusion” of the “greed, hate and delusion” formula is the illusion that our continuous self is real and the illusion of objects and phenomena that we perceive have continuous self (own-being). These perceptions allow for the entire machinery of dualistic conceptualization, desire, craving, aversion, attachment, grasping and suffering to operate.

Nirvana is the ending of greed, hate and delusion. This is shown in the *Nibbānadhātu Sutta* (“Elements of Extinguishment Discourse” - Iti 44) where it states:

It's when a mendicant is a perfected one, with defilements ended, who has completed the spiritual journey, done what had to be done, laid down the burden...The ending of greed, hate, and delusion in them is called the element of extinguishment with residue.

We saw earlier in this chapter that nirvana was the experiential sphere where no objects or phenomena can be cognized. The timelessness of nirvana removes what continuous selves need to perceptually exist as objects of mind: a sense of the passage of time. Without this prerequisite there can be no objects that arise and pass away and thus no suffering.

This is the non-discrimination of Zen. Non-discrimination is not a technique or a strategy; it is what is left over when the illusion of continuous and separate selves evaporates in light of nirvana. This is the end of aversion

and attachment. The great Zen Master Hui Hai sums it all neatly for us¹⁶⁷:

“As for present things, they are already present. With regard to everything, simply remain aware without clinging’. What is meant by ‘without clinging’? Not giving rise to a mind of aversion or attachment: this is being without clinging. Then the mind concerned with the present naturally ceases, and this is called ‘there being no present things.’ Not being encompassed by the three times is also called ‘there being no three times.’”

Non-Duality (Advaya)

We saw earlier in this chapter how “arising and passing away” can be defined as a lack of mental time travel regarding mental representations. We can see this phrase being used in the *Mahāratnakūṭa Sūtra* (“Great Collection of Jewels Discourse”) and see that the teaching is that without mental time travel, we see the real nature of reality and this is nirvana:

“There is no arising and there is no passing away (no time); this is the true character of phenomena.

...

*This is called nirvāṇa;
within it there is nothing that ceases.
If one speaks of ‘far’ or ‘near,’
both of these are empty.
Whoever knows emptiness
is thereby said to know nirvāṇa.”*

“Far” or “Near” are examples of the dualities found in dualistic conceptualization. When the emptiness of dualistic thinking is seen, this non-duality leads to the peace of nirvana. Non-Duality is a frequently discussed topic in Mahayana in general and Zen in particular. A Zen teaching on non-duality can be found in the Platform Sūtra:

“With regard to the aggregates and elements, ordinary people see duality. The wise comprehend their nature as

¹⁶⁷ From the *Dunwu rudao yaomen lun* (“Treatise on the Essential Gateway to Entering the Way through Sudden Awakening.”)

without duality. The nature that is without duality is Buddha-nature."

And there is this quote from Dahui Zonggao:

"Mind and Buddha are nondual; things and self are one suchness. If one truly realizes one-suchness, one no longer sees the designations 'things' and 'self.' If one truly realizes nonduality, one no longer sees the characteristics 'mind' and 'Buddha.'"

There are different types of non-duality in Buddhism. For example, when we explored the differentiating awareness (*viññāna*) aggregate earlier in this book, we noted that it involved consciously being aware of objects perceived through senses of objects as being separate from each other.

The Yogacara school of Mahayana Buddhism defines a type of duality where there is the illusion of the "grasper and grasped at" that exists within differentiating awareness. This definition of duality has been influential within Zen through the *Laṅkāvatāra Sūtra* which was popular amongst early proto-Zen communities. Unlike the raw perceptual duality of differentiating awareness, this type of duality is more conceptual and discriminating in nature. The following passage from the *Laṅkāvatāra* shows how this type of duality is conceptual in nature:

"The seeds within consciousness manifest the domains of mind. Foolish beings give rise to discrimination/conceptual differentiation and falsely conceive grasper and grasped".

While Yogacara focuses on self/other conceptual duality, of streams of Mahayana Buddhism this type of non-duality becomes generalized to any type of conceptual dichotomy. This is probably best represented in a Mahayana scripture called the *Vimalakīrti Sūtra* in which there is a chapter called the "Dharma Door of Non-Duality". There is a scene in this chapter where many famous bodhisattvas are hanging out and are sharing their own opinion about what non-duality is. Some examples are:

The bodhisattva Universal Guardian said:

"'Self' and 'no-self' are two. The self itself cannot be apprehended, so how could 'not-self' be apprehended? One

who sees the real nature of self no longer gives rise to the two. This is to enter the Dharma-gate of nonduality."

The bodhisattva Flower Adornment said:

"To give rise to duality on the basis of 'I' is itself duality. One who sees the real characteristic of 'I' does not give rise to two dharmas. "If one does not abide in two dharmas, then there is no consciousness [that divides them]. Where there is nothing to be cognized, this is to enter the Dharma-gate of nonduality."

The bodhisattva Treasury of Virtue said:

"The characteristic of having something to attain is duality. If there is nothing to attain, there is no grasping and no rejecting. Where there is neither grasping nor rejecting, this is to enter the Dharma-gate of nonduality."

These are just a few of the many examples, and afterwards they asked Mañjuśrī to give his definition and he answered:

"As I understand it, with regard to all dharmas, there are no words and no speech, no showing and no knowing. One leaves behind all questions and answers. This is to enter the Dharma-gate of nonduality."

And then he asked Vimalakīrti to give his definition and Vimalakīrti was simply silent and then Mañjuśrī says:

"Excellent! Excellent! When there are not even written signs or spoken words, this is the true entry into the Dharma-gate of nonduality."

The primary point here is that this type of duality is defined as the conceptualizing of dichotomies. It is discriminatively conceptualizing objects or phenomena in terms of two opposed categories. As compared to the perceptual non-duality of differentiating awareness (*vijnana*), I would call this conceptual non-duality.

Which one is Zen pointing to when it references non-duality? Is it the perceptual non-duality of differentiating awareness (*vijnana*) or the

conceptual non-duality of the *Vimalakīrti Sūtra*? I would argue that it is conceptual non-duality. Strong evidence to support this view is this passage from the *Platform Sūtra*:

"Good roots are spoken of in two ways: permanent and impermanent. Buddha-nature is neither permanent nor impermanent; therefore it is called nondual. One is good and the other not-good; Buddha-nature is neither good nor not-good, and this is called nondual. With regard to the aggregates and elements, ordinary people see duality; the wise comprehend their nature as without duality. The nature that is without duality is Buddha-nature."

Huineng is not talking about ontological non-duality. He is giving a series of binary conceptual categories that are delusional. Here is more of this type of conceptual non-dual content that can be found in the *Platform Sūtra*:

"The Way has neither light nor darkness. Light and darkness signify alternation. Even 'illumination upon illumination without end' still involves an end, because the names are established in mutual dependence. Therefore the Vimalakīrti Sūtra says: 'The Dharma has nothing to which it can be compared, because it is not established through mutual dependence.

...

Illumination and ignorance: ordinary people see them as two; the wise comprehend that their nature is not two. The nature that is not two is the true nature."

The neuroscience of differentiating awareness (*vijnana*) non-duality vs the neuroscience of conceptual non-duality can help illuminate why conceptual nonduality might be more relevant to liberation from suffering from a naturalistic Zen point of view. We saw earlier that differentiating awareness (*vijnana*) had likely neuro correlates of a brain region called the inferior intraparietal sulcus. This is important in the context of the fact that what generally drives craving, grasping and suffering is the default mode network, and the inferior intraparietal sulcus is not part of it. The inferior intraparietal sulcus and its mental representations of objects is an important part of normal brain function during perception and there are not any studies that implicate its uncontrollable functioning is in any way tied to mental suffering. Mental suffering comes from much higher-levels of cortical

cognition that involves self-referential conceptualization built around mental time-travel and this is default mode network territory.

Another type of experience that people can have when meditating or taking psychedelics that can be labeled as non-dual is when their physical sense of being a body is altered in a way where it disappears or its boundaries become more porous and it becomes difficult to distinguish between body and not-body. Going back earlier in the book this type of body schema, body boundary and body ownership cognition is correlated with the posterior parietal cortex and insula brain regions. Neither are part of the default mode network functioning involved in the type of dualistic conceptualization that causes emotional suffering. In fact, I have had “non-dual” experiences where body boundaries and ownership are dissolved during meditation, *and I did not like at all*. It was kind of like a “bad trip”. I can attest that my narrative self’s ability to have emotional unpleasant opinions about what was going on was not at all diminished by this type of embodied non-duality. Fairly frequently, people will have these types of “non-dual” experiences and wonder if it’s a type of “enlightenment” that they are experiencing. I would say no, because neither the posterior parietal cortex nor the insula are part of chain of causation that leads to suffering. In these cases, the embodied sense of self gets altered but the narrative “I exist” part of self can remain fully intact and can keep complaining.

It can get nuanced when in some altered mind states both the embodied and narrative senses of self can be attenuated or temporarily vanish and it can seem like the same unified experience, but nuanced experiential observation and neuro correlate mapping can show they are dissociable. One study that helps us understand this dynamic is the 2024 Israel study¹⁶⁸ of deep meditation states that we explored in the Meditation (Zazen) chapter. One of the things we learned from that study is that the part of the brain where different senses of self are brought together is the rear of the default mode network. In lighter trances, the embodied-self starts to become attenuated. If my experience is any indication, this does not yet disable to chain of causation that leads to suffering. Then at deeper trances self-existence at a deeper level begin to go as well and this is where people begin to experience state-level liberation from suffering since the continuous and narrative selves are not running their judgmental simulations. There is no active dualistic conceptualization. Other studies show it can go the other way too where mindfulness-based practices that are less trance-based can reduce narrative sense of self without altering differentiating awareness or embodied sense of self. This is helpful because it would be impossible to interact

¹⁶⁸ (Trautwein, et al., 2024)

with the world without differentiating awareness or an embodied sense of self. We need these two aggregates to be functional to successfully interact with the world.

21 - BUDDHA-NATURE (BUSSHO)

Perhaps the most famous koan in Zen is “Joshu’s Mu”. Even if it’s not the most referenced koan in Zen texts, and it probably is, it is certainly the most commonly assigned koan to Zen students who engage in formal koan introspection. The text of the koan is the following:

*“A monk asked Joshu, does or does not a dog have the
Buddha Nature. Joshu answered, Mu!”*

An orthodox teaching in Mahayana Buddhism is that all sentient beings have Buddha-nature so it is rather odd that Joshu would say that a dog does not have Buddha-nature. Assuming he was familiar with basic Buddhist teachings, he was clearly making a point that is illustrated in a verse that Wumen (the compiler of the koan collection) wrote about the Mu koan:

*“The dog’s Buddha-nature:
the true command is fully brought forth.
The moment you enter into “has” or “has not”,
you lose body and life.”*

This is basically saying that the student inquired about the dog’s Buddha-nature but Joshu’s “Mu!” is actually like a directive that brings forth the “command” to focus on what really matters. And what matters is that if you get lost in the dualistic conceptualization of “has or has not”, you will not awaken and will still be subject to birth and death. The third line is the one that is most important to what we will explore in this chapter. We will explore how getting caught by dualistic conceptualization causes us to suffer and the emptiness of Buddha-nature is the catalyst of liberation.

Buddhist Teachings About Self

One of the central liberative teachings of Early Buddhism is the concept of “not-self”. This teaching revolves around the logic that what we conceive as our body and mind (the five aggregates), are actually not the self. He argues that if the body and mind were the self, they would be unchanging. Next, he argues that if the body and mind were the self, they would be under our complete control. Anyone who has tried to hold their attention on a single source for the first time quickly figures out that they are not in control of their minds. The Buddha’s fundamental argument regarding the body and mind not being the self is that if they were in fact the self, they would not cause suffering. These three arguments might seem strange, but they are better understood if one recognizes that in the religious and philosophical landscape of his era, one popular teaching was that the “Self” was considered to be essentially a soul that is eternal, in complete control and does not experience suffering. In light of that knowledge, his teachings on the relationship between the self and the body and mind gain a coherence they would not have otherwise. The erroneous cognitive appraisal that the body and mind are actually our self is called “identity-view”. The identity-view is part of the processing of what we have defined as the narrative self in this book.

Another self-related teaching in Early Buddhism is that prior to awakening, humans have a sense of self that is labeled as the conceit “I am”. This sense of being is the root of dualistic conceptualizations and is wiped out at the moment of awakening. It is said that even if a practitioner wipes out their identity-view, there can remain a more fundamental and pre-cognitive sense of self. I would argue that this maps to what we have defined here as the continuous self. Not because the Early Buddhist teachings discuss a sense of self-continuity when discussing “I am”, but because we have explored the idea that an underlying sense of continuity is the essentially unnoticed underpinning that lets us feel like we exist in the first place. This sense of “I am” drives the dualistic conceptualizations that lead to craving, grasping and suffering.

If we think back to the “Self-Perception (Atman)” chapter, we can observe that the different elements of “self” that we have explored were not entities or “things” that we can perceive; they are processes of self-perception and cognition itself. “Self” is not a “thing” that perceives the world; rather “self” is an activity of active perception. Unless something unusual happens like a meditation trance, ingestion of psychedelics or a brain injury, we don’t typically notice these individual dimensions of self independently.

Rather we experience them all combined together as an illusion of unified self-perception. Different dimensions of self can have varying degrees of dynamic attentional focus or become attenuated depending on what we are encountering, but on the whole, we just feel like there is a “self” even as it shape-shifts to meet the moment. I see this as being what the “I am” conceit is that we just discussed. It’s the general, unified experience of being or having a sense of self.

The last Early Buddhist teaching on self that we will explore is an idea that is expressed in the commonly used phrase: “I-making, mine-making, and the underlying tendency to conceit”. The Early Buddhist texts do not give a direct definition of this phrase and contextual use isn’t much help either, but I-making and mine-making are clearly actions/processes. Just looking at it semantically and thinking about which major aspects of naturalistic self-cognition have not been defined yet, my guess is that these terms represent the activity of determining how self-referentially important something is to us. For example, if I am doing some spring cleaning and I am sorting through a bunch of objects in a drawer and putting things in a “donate” or “keep” box, making this determination involves making an assessment of how much self-relevance something has. It is the act of seeing what belongs to us or what has value for us. I think we could say that it is “I-making” because in order to know what is important to us, we first have to know what we are. It is “mine-making” because the next step is to evaluate what will help us feel safe, secure, healthy and happy based on our sense of self identity.

The texts of Mahayana Buddhism don’t spend a lot of time questioning what is real about the self or not. They are mostly concerned with the teachings that say that all things are empty of any sort of inherent self. It’s not just ourselves that lack inherent existence, it is everything. After emptiness, the next major development in Mahayana Buddhism was the development of what are called the Buddha-nature teachings. In these sutras and commentaries, they make the claim that the Buddha did not really disappear at death and is really a kind of universal being. Less grandly, but very importantly the Buddha-nature sutras are where the idea that all beings have Buddha-nature was introduced. Within these Buddha-nature texts, there are teachings that describe Buddha-nature as a “Self” that is eternal and contains attributes like permanence, purity and bliss. This may sound surprising, but if you think about it, the earlier non-self teachings of Early Buddhism were that the five-aggregates lacked these “capital S” Self attributes not that this Self did not exist at all. The teachings were that a personal “I-am” perception is what was illusory, not that there was not some universal Self that had the qualities of permanence, purity and bliss.

If this seems a surprising and even contradictory teaching in the light of the doctrine of emptiness, it was also to people back when these teachings were first introduced. As such, the authors of the Buddha Nature teachings were careful to emphasize that this Buddha-nature Self is not the personal-self and insist on its compatibility with emptiness. Zen has been highly influenced by the Buddha-nature teachings and lots of their language focuses more on an affirming theme of “you have Buddha nature” rather than a negating one such as “nothing you think is you is really you”.

Not Knowing and Dualistic Conceptualization

The Mu koan is an invitation to experientially go beyond the dualities of “has and has not”. Not-knowing is considered the antidote to the manner in which dualistic conceptualization can lead to craving, grasping and suffering. To help explore why this might be so, let’s consider the following scenario: Let’s imagine that you have been working at an accounting job that you really like for three years. You and your whole team are summoned to a conference room, and your boss announces that the company that you work for has been bought by a larger company. You quickly look them up and you discover they have a history of laying off the accounting departments of their acquisitions. You and your spouse just had a new baby and urged them to quit their job and be a stay-at-home parent. You know from talking to unemployed friends that it is really hard to find a new accounting job right now.

We will first look at how a hypothetical “normal” person might perceive and respond to the scenario and then from the perspective of a hypothetical awakened person. A normal “non-awakened” person would likely go through the following sequence of steps. The five aggregate processes would be the underlying drivers of these cognitive actions.

1. **Preexisting Predictive Preferences** – The brain maintains a prior belief that the job seems secure and financial commitments will be able to be met. There is a preference that maintenance of the status continues.
2. **Perception** – The aggregate of perception would receive the sensory input during the meeting and categorize all of the relevant concepts and entities.
3. **Mental Representation** – The differentiating awareness aggregate would create mental representations of all the necessary separate components of the situation so that they can be processed.

4. **Prediction Error** – Once the cognitive representations of the scenario are in place, the salience network detects the first inkling that the prior prediction inferences were in error and preferences are not being met so it throws up the “prediction error” alert. Some immediate aversive mental feeling tone sensations are beginning to emerge.
5. **Initial Self-Relevancy Analysis** – Within the scope of the decision-making aggregate, the central executive network performs a deep analysis of the situation making significant use of the default mode network’s narrative self to determine how big of a deal this is from a self-referential perspective. The narrative self’s dualistic conceptualizations and simulations determine this to be a very big deal, and the default mode network starts activating the suffering circuit as a punishing motivator to get us to solve the problem. Since the situation is a very big deal, the volume of the emotional suffering is turned up pretty high. The central executive network begins to coordinate analytical reasoning to identify what our options might be to deal with this situation.
6. **Option Simulations** – Still within the scope of the decision-making aggregate, the central executive network works with the default mode network’s narrative self to run simulations of each option available to us to respond to this scenario. The option that predicts the most favorable feel-tone results will be selected. After deliberation, an option is selected, and a desired goal (preference) is defined and set: “Get a new job ASAP!” Some people get stuck here and are unable to even select an option, but at least we are able to see what needs to happen.
7. **Promotion to Craving** – Since our brain’s dualistic conceptualizations have determined that having a job and not being homeless have pretty big survival consequences on multiple levels, our desired goal is promoted to being an active process of craving.
8. **Goal Check Ins** – After the desired goal has been selected, the salience network frequently recognizes that a goal is defined and checks in on it. Sometimes randomly based on internally-generated thought and sometimes because it is reminded by things or situations that it encountered through perception. The brain has a strongly preferred outcome of finding a new job and at the check in, the default mode network’s narrative self is asked to run a simulation to figure out if a path to making that prediction comes true is easy to envision or not. If there is uncertainty, the default mode

network will activate the suffering circuit with a big jolt to continue to motivate us to find a way to work to reduce the uncertainty.

9. **Ongoing Grasping** - Since the survival consequences are considered so high, the salience network frequently performs the checks to see how things are going. With each new revisit the default mode network contributes to the conceptual thinking and simulations of the future. Each time there is a recognition of uncertainty in obtaining the goal, the default mode network zings us with a big jolt of worry-based negative feelings through the suffering circuit. Since so much is riding on getting a new job, this grasping at the goal will be intense and ongoing.

At various points during this process the default mode network needs to run simulations of the future and heavily participate in dualistic conceptualization. The simulations of the future are designed to determine what potential scenarios might be like and how they are likely to make us feel. The dualistic conceptualizations contribute to these simulations and then evaluate the predictions that they make. An example of a dualistic conceptualization contributing to a simulation could be the thought "It is really hard to find a job right now and I am not sure I could get a new one in time if I was laid off in the near term". This could spawn or contribute to a simulation that tries to predict what life would be like if you were laid off right away. If your default mode network ran another simulation about what your partner's reaction would be if you were laid off, you could very well spawn the dualistic conceptualization, "my partner will be crushed when they hear the news" or "I must do everything in my power to find a new job right away".

Dualistic Conceptualization and the Identity Self

All of these types of dualistic conceptualizations filter through and emerge from what we have called our identity self. Our identity self is a complex schema of our beliefs about ourselves and the beliefs about the world as it relates to us that is managed by the default mode network. For example, "I need a big house to be happy" or "the south side of town is dangerous" would both be examples of beliefs in our social self schema.

Freedom from Conceptualization

When Zen teachers talk about “not knowing” it points to the role dualistic conceptualization and the prior beliefs in the identity self schema play in the chain of causation that leads to suffering. “Not knowing” is a short hand way of saying that freedom and liberation comes from not being constrained and controlled by our beliefs. Suzuki Roshi, who founded the San Francisco Zen Center, called this not knowing, “Beginners Mind”. The importance of going beyond beliefs dates back to the earliest years of Buddhism. For example, in the *Dhammapada* we can find this:

*“There is no track in the sky;
There is no samāṇa outside.
[Ordinary] people delight in dualistic conceptualization;
The Tathāgatas (Buddhas) are without dualistic conceptualization.”*

In the Nippapañcapāṇha (“The Question about Freedom from Dualistic Conceptualization” - Mīl 6.2.1), they get straight the point:

“The fruit of being awake (arahantship) is freedom from dualistic conceptualization.”

One more sutta excerpt we will look at is from the *Aggivaccha Sutta* (“Discourse to Vaccha on Fire” - MN 72):

*“But does Master Gotama hold any particular fixed view?
Vaccha, fixed views have been removed from the Tathāgata
(the Buddha).”*

Now moving forward in Buddhist history, we can see in this excerpt from Nagarjuna’s *Mūlamadhyamakakārikā* (“Root Verses on the Middle Way”) that he ties the transcendence of dualistic conceptualization to emptiness:

“Liberation comes from the cessation of karma and afflictions (greed, hate and delusion). Karma and afflictions arise from conceptual representations. Those representations arise from dualistic conceptualization, but dualistic conceptualization ceases in emptiness.”

Earlier we have seen that objects have no place to “take hold” in nirvana and that all objects are empty of any own-being. Seeing that dualistic conceptualization is also empty it is helpful to see how own-being and dualistic conceptualization interrelate. This is explored in this teaching from the Indian sage Candrakīrti where he elaborates on the above passage from Nagarjuna in the *Mūlamadhyamakakārikā* (“Root Verses on the Middle Way”):

Thus, karma and the afflictions proceed from discrimination. And those discriminations arise from the diverse dualistic conceptualizations habituated throughout beginningless saṃsāra, characterized by such things as knowing and known, what is denoted and what denotes, agent and action, instrument and activity, pot and cloth, crown and chariot, form and feeling, woman and man, gain and loss, pleasure and pain, fame and disgrace, blame and praise, and so forth.

And this entire worldly dualistic conceptualization ceases in emptiness when there is the seeing of the emptiness of all own-being.

Dualistic conceptualizations depend on perceiving the illusion of own-being of objects and phenomena. We saw earlier in the book that when the ability to see own-being (the sense that an object actually exists) is combined with the ability to differentiate objects, this allows dualistic conceptualization to track and conceptualize about specific entities. For example, in the above scenario, if we did not see entities like “my partner”, “my job”, “me being unemployed”, “my boss” as real objects and phenomena, then there really would be nothing to conceptualize about.

Since transcendence from dualistic conceptualization and the underlying entities that it conceptualizes is how a hypothetically fully awakened person experiences reality, let’s make an informed guess at how they would respond to the scenario where they find out that they might lose their job. Before we do that, let’s pause and consider a lurking question you may have had up till this moment in this chapter. This question is, how is someone supposed to interact with reality if their mind does not recognize individual objects and phenomena as actually existing in an identifiable manner? While it is intuitive to see how a mind would be free from grasping at individually conceptualized objects because there are in fact no individually conceptualized objects, one would have to wonder though how such a mind could interact with reality at all. How would you tell your partner apart

from a random person from the mall? How could you identify a job you would want to apply for?

We are not the first people to recognize this challenge and necessity of understanding these implications of these teachings. Different schools and sects of Buddhism address this problem in different ways, and it is beyond the scope of this book to go into it here. Since this is a Zen focused book and the Zen response to this is the most naturalistic anyway, we will focus on this way of looking at the situation. The Platform Sūtra has a very relevant teaching on how an awakened mind would deal with interacting with reality in this context:

“Thought arises from the inherent nature of suchness. Although the six faculties see, hear, sense, and know, they are not stained by the myriad objects, and the true nature remains continually free. Therefore, the scripture says:

‘Skillfully distinguishing the characteristics of all dhar-mas, while remaining unmoved with regard to the ultimate meaning.’”

In some ways it is the simplest of possible answers to the question and probably the one many Zen practitioners have experienced to some degree themselves: from a practical and experiential perspective, an awakened mind actually retains its capacity to sense and mentally represent objects and phenomena, it just does not get captured by them in a way that leads to clinging and grasping. From this perspective, the perception of the lack of own-being comes into play in certain circumstances of cognition and does not mean this facility of mind is completely gone when interacting with the world in a conventional manner. To illustrate this now that we have completed this digression, let’s see how an awakened mind would deal with the job loss scenario:

1. **Preexisting Predictive Preferences** – The brain maintains a prior belief that the job seems secure and financial commitments will be able to be met. There is a preference that maintenance of the status continues.
2. **Perception** – The aggregate of perception would receive the sensory input during the meeting and categorize all of the relevant concepts and entities.

3. **Mental Representation** – The differentiating awareness aggregate would create mental representations of all the necessary separate components of the situation so that they can be processed.
4. **Prediction Error** – Once the cognitive representations of the scenario are in place, the salience network detects the first inkling that the prior prediction inferences were in error, and preferences are not being met so it throws up the “prediction error” alert. Some immediate aversive mental feeling tone sensations are beginning to emerge. Note that this is unchanged from how a “regular person” would experience this step. There is nothing in our model of awakening that would keep negative emotional feeling tones from arising.
5. **Initial Self-Relevancy Analysis** – Within the scope of the decision-making aggregate, the central executive network performs a deep analysis of the situation making significant use of the default mode network’s narrative self to determine how big of a deal this is from a self-referential perspective. The narrative self’s dualistic conceptualizations and simulations run within a context where the “own-beings” of the entities that are being conceptualized have no weight, so this is not determined to be “punishment worthy”. The “characters” in the narrative self’s stories are not graspable, so there is no suffering generated here to tack onto any aversive feeling tones generated in the last step. Still the brain can semantically and logically determine something needs to be done with the situation, so the central executive network begins to coordinate analytical reasoning to identify what our options might be to deal with this situation.
6. **Option Simulations** – Still within the scope of the decision-making aggregate, the central executive network works with the default mode network’s narrative self to run simulations of each option available to us to respond to this scenario. The option that predicts the most favorable feel-tone results will be selected. After deliberation, an option is selected, and a desired goal (preference) is defined and set: “Get a new job ASAP!”. The fact that the nouns in the simulation lack own-being doesn’t mean that they can’t be thought about so the logical decision to get a job still gets made.
7. **Goal Set** – A desired preference has now been set. Since none of the noun entities in the simulations that set the goal had own-being, there is no promotion to craving.

8. **Goal Check Ins** – Now that the desired goal has been selected, the salience network frequently recognizes that the goal is defined and occasionally checks in on it. Sometimes randomly based on internally-generated thought and sometimes because it is reminded by things or situations that it encountered through perception. The brain has a preferred outcome of finding a new job and at the check in, the default mode network's narrative self is asked to run a simulation to figure out if a path to making that prediction comes true is easy to envision or not. Even if there is uncertainty, the default mode network does not activate the suffering circuit because there is nothing to grasp at due to the noun entities in the simulation being empty of own-being.

The awakened mind was still able to function and think logically based on the information at hand. The only real difference was that since the noun entities of the “stories” of the narrative self's simulations did not have anything graspable about them, there was no suffering produced. There was still conceptualization, but we can't really call it dualistic conceptualization. This is how not-knowing plays out in the awakened-mind. Nothing that is thought about has the solidity of a firm knowing. This is nonduality in action.

A very important point to notice here is that the cognitive functioning that kept any craving and grasping from occurring did not require any volitional and explicit mindful attentiveness. It came from a default way of being that does not create craving and grasping. This default way of being is our unborn Buddha-nature.

Everything is Resolved in the Unborn

One of my favorite Zen masters is Bankei Yōtaku. I remember when I first started practicing Zen, I would sit in the library of Humboldt State University devouring works on Zen Buddhism and Indian Mahayana teachings. I remember once I found a book about Bankei and started reading it and came across a passage that included the text “everything is resolved in the Unborn”. I can't really articulate it, but it hit me like a freight train. For a brief moment, I knew exactly what he was talking about. Something in me could intuitively sense Unborn Buddha-nature and it motivated me to double down on my practice and sustained me for years. Ever since I have had a soft spot for Bankei and his down-to-earth and psychologically grounded teaching. Here is a translation of the excerpt I was reading that day:

“The Buddha Mind is nothing other than Unborn luminously aware. Because the Buddha Mind is Unborn, everything is resolved in the Unborn. Therefore, all of you remain in the Unborn. If you remain in the Unborn, this is what the Buddhas are said to have attained. Is this not something precious? Once you know the preciousness of the Buddha Mind, even if you wanted to become deluded, you could not.”

As I have hopefully established up to this point in the book, time-related cognition is at the heart of how the brain creates a sense of self. Bottom-up mindfulness practice is mostly about invoking a sensory-first way of being that brings us out of mental time-travel and into the absolute reality of the timelessness of current moment. This reduces self-related cognition in a somewhat brute force manner.

“Top-down” practice is where a present-moment rooted mind becomes a default way of being. We see the first inkling of this in the trait mindfulness that can develop from consistent meditation practice. The end of this path would be what Zen texts have called the Wonderous Mind of Nirvana where self and objects are said to be unborn and thus empty of anything that can be craved and grasped at. At this stage of practice it goes beyond mere trait mindfulness and the mind’s center of gravity is rooted in the absolute realm of timelessness. It is not a state of mind that can be entered into and exited; it becomes a way of being.

Unfortunately, science has no way of positively distinguishing who might be fully awakened and who might simply be a very advanced practitioner. If there was, we could say a lot more about what the neuro correlates of an awakened mind are. Since that is not possible the best we can do is come up with a well-considered theory and that is what I will attempt to do here.

Empty of Own-Being

Buddha-nature is called ultimate emptiness; ultimate emptiness is called wisdom. - Mahāyāna Mahāparinirvāṇa Sūtra

Before we define and discuss emptiness, I think it can be helpful to take a moment to emphasize that the ultimate goal of Buddhism is soteriological and not ontological. What this means is that Buddhism is fundamentally

about “how does a person escape suffering?” and not “what is actually real in the world?”. Often this distinction is lost in scholarly treatments of Mahayana concepts. The discussion here is not about what we can know as real or not from a physical perspective, it’s about different ways that we, as organisms, perceive and process perceptions about our bodies and the world. That goal is to determine which way of processing reality causes suffering and which way does not.

When defining emptiness, a lot of teachers, authors or scholars first turn towards an explanation centered around the equality between it and interdependence. I would assert that a clearer investigative approach is to start with these excerpts from Nagarjuna’s *Śūnyatāsaptati* (“*Seventy Verses on Emptiness*”):

“Everything expressible is, like nirvana, empty of own-being...No own-being is found in any phenomenon; therefore, it is empty.”

And:

“No own-being is found in any phenomenon; therefore, it is empty”.

Emptiness means empty of own-being.

If you look at something and notice it, what shows up in your awareness is not actually the object but an abstract and predictive representation of it. Our brains are locked in a windowless and bone container with no direct contact with the outside world. Anything it knows about the world comes from variable electrical signals flowing in from sensory organs. Those sensory signals then get broken up and sorted into individual separate mental representations. Each individual representation of an entity is a predictive inference of what the actual perceived object might be like. For a representation to exist in our mind requires an active and ongoing predictive simulation of it based on the updating sensory signals that are streaming in. We can also build these types of object representations from our memories of objects that were perceived in the past or we can create imaginary ones by constructing simulations in our mind.

Once an object representation has been established it can be conceptualized as having its own unique existence. We can apply dualistic conceptualizations to it and have beliefs about what it means to us from a self-referential perspective. Once we can think about an object and identify it as an individual entity in a conceptual manner, its mental representation begins

to seem like something with its own-being. At that point we can make predictions about it and make feeling-tone assumptions about it. For example, I can look at a restaurant and get an immediate predicted sense of having an opinion about it from the perspective of how interacting with it will change the way I feel. That own-being character only exists if we dualistically conceptualize it. If an object representation from real-time perception, memory or imagination is not actively being reified, it loses its quality of being real. It becomes “empty” of own being.

Emptiness is not a lack of representation of an object in the mind; it is a lack of thoughts, feelings and predictive beliefs that identify and define it. Without active conceptualization about an object residing within and being held by our attention, there can be no mental time travel about it. Without active time-travel derived predictions about an object, it is empty of anything that can be craved, rejected or grasped at. If it is not graspable, it can not be a source of greed, hate and delusion and cannot participate in suffering. Without being able to consider its history and predicted future through mental time travel, it lacks identity in terms of what it means to us in a self-relevant manner.

In Nagarjuna’s *Śūnyatāsaptati* (“*Seventy Verses on Emptiness*”) he says:

“No own-being is found in any phenomenon; therefore, it is empty”.

A perception of own-being comes from our ability to hold a mental representation of an object in mind while cognizing it as a continuously existing entity. This allows us to recognize it as an individual object with personal relevance through time-traveling dualistic conceptualization. To see this process in action, let’s consider that we are walking down the street and come across someone we once knew from college. As you recognized them, your brain would automatically load in some predictive beliefs about them. Your brain will try and get a sense of the perceived identity of that person. Based on that identity, our brain can make a decision on what to do in regard to noticing them. Simulations will be run first considering what it would be like to say hi to them and then on what it would be like to pretend you didn’t notice them and keep on walking. Your perceived “identity model” of them would play a big part in those simulations. For example, if the way you perceived their identity was that they are warm-hearted and pleasant to talk to, you might be more likely to stop and say hi. It is also possible that you might remember how they were mean and belittling to you. In that case, even reliving those memories through recreated simulations of the past would likely generate an aversive emotional reaction. Just

seeing them would make you angry and the more you remembered about their behavior and thought about it, the worse you might feel. Your thoughts would seem real, and the perceived identity would seem real. Unless you were awakened, of course. To get a sense of how the awakened mind might react to the situation, let's explore the mindfulness principle that has been called "decentering" to use as a model.

Within the science of mindfulness, decentering is proposed to be the ability to experience thoughts, feelings, and memories as temporary mental events instead of as part of self-identity. This lack of reification is true of both our own identity or the identity of external objects and phenomena that we are perceiving. It involves objective meta-awareness and reduced self-identification with mental content which decreases automatic and habitual reactivity to that content. Meta-awareness is defined as the capacity to objectively be aware of the current contents and processes of one's own mind without reification or grasping. With meta-awareness, the mind becomes objectively detached from thoughts, feelings, and memories happening instead of being carried away by them mindlessly. One seminal paper¹⁶⁹ on decentering, by the Israeli researcher Amit Bernstein and his team, proposes that observing a thought creates a distinction between the observer and the observed mental activity which reduces self-identification with it. In the case of a hypothetically fully awakened mind, there would be no observer so the distinction would be between "observing" and the observed mental activity.

Thoughts that contain predictive beliefs are what constitute the clingable components of what we perceive as an entity's own-being identity. What makes the dualistic conceptualization of a predictive belief specifically clingable are the self-referential implications of the belief. If a narrative-self simulation predicts feeling-tone or survival consequences it becomes consequential from a self-referential perspective. Normally, such a belief would be very sticky and generate a cascade of time-traveling dualistic conceptualization for a person. If, however, there is decentering that separates the thought from self-referentiality, the conceptualization that assigns identity-projecting own-being onto a mental representation of an object would pass into and out of awareness without craving and clinging and thus there would be no suffering. In that case, the mental representation of an object would be empty of own being since nothing is sticking to awareness and getting reified. Since the underlying "neutral" mental representation of an object would be untouched by the emptiness process, it is still available to cognition for thinking and problem solving. This dynamic is represented in

¹⁶⁹ See (Bernstein, et al., 2015)

this teaching from the *Platform Sutra* that we saw earlier: “Although the six faculties see, hear, sense, and know, they are not stained by the myriad objects, and the true nature remains continually free”.

The Amit Bernstein paper mentioned above proposes that meta-awareness redirects attention from the content of a thought to the process of having the thought. This creates psychological distance between the thought and the observer. This shift in attention drives decentering by making the thought less likely to automatically capture attention, trigger grasping-based repetitive negative thinking, or to trigger automatic behavioral reactions. Earlier we discussed the concept of dispositional or trait mindfulness. The more likely that someone automatically or easily resides within present-moment-awareness, the more likely a thought will pass in and out of awareness. A 2024 review study¹⁷⁰ indicated that the most consistent neuro correlates of trait mindfulness were reduced connectivity within the default mode network. From a “what does it feel like” perspective, a reduction in default mode network activity reduces the amount of self-referential thought while reduced default mode network internal connectivity correlated with of reduced sense of self or self-referential salience. In the later case it is not less thinking, but less of a sense of self while thinking normally. A theoretically fully-awakened mind would presumably have maximum reduction in default mode network connectivity and thus a true freedom from a fixed sense of self. This would be the deep freedom of an actualization of Buddha Mind. The mind of Nirvana.

To make all this concrete let’s revisit the scenario where we find out that our company is being purchased by another company and as a result our job and thus our livelihood is threatened. What would specifically be the entities with own-being at play in this scenario? There are many, but let’s choose one that is abstract so that we can see the own-being dynamics at work in a very subtle manner. Let’s single out “my current job”. Our brain has a general classification of “jobs” in the self-identity schema but this in this case we looking are looking at a specific job: the one we currently have. What gives the entity “identity” and thus what makes it graspable are the time-traveling thoughts and beliefs we have about it. Prior to the announcement, our future-oriented beliefs may have included “this job is stable”, “this job will continue to make me happy” and “this job will continue to let me support my family”. Since ongoing grasping is initiated through recognition of a prediction error (unmet expectation), a real-time thought such as “I thought my current job was stable and would allow me to continue to support my family” would certainly qualify. A “normal” mind would

¹⁷⁰ See (Treves, et al., 2024)

likely grasp at significant survival consequences and latch onto it. An awakened mind with full decentering capacity would see the thought come into awareness and then flow out with no friction. The entity “my current job” would lack the characteristics that gave it identity from a self-interested perspective. The job would be empty of graspable characteristics that felt “real”. We saw early that this sense of realness is called “*parikalpita-svabhāva*” which can be translated as “imagined own-being”. It is buying into the illusion that causes us trouble. When mental phenomena passes into and out of awareness with no friction, there is no buying into the illusion.

As we have explored earlier, there is timelessness or a lack of “arising and passing away” of phenomenon in the mind of nirvana. What attenuates or removes the sense of an entity having its own individual identity is a lack of uncontrolled mental time travel. If an entity is not firmly associated with a history and a story in our mind, its “real nature” would just be an anonymous object representation in real-time. None of the characteristics that made it seem like it had its own-being would seem like they actually existed. Histories and stories come from the time-traveling simulations of the default mode network. Cognition within the context of time creates identity for both ourselves and the objects we perceive in the world around us. When our attention is anchored in, but not bound by, the absolute reality of present moment in a profound and lasting way, this is the substrate of nirvanic mind and the mechanism of emptiness. It is the functioning of our Buddha Nature.

Returning to Bankei, he says of this freedom in a way that remarkably mirrors what has been discussed in this section:

“Let thoughts arise as they arise and cease as they cease. If you neither take them up nor reject them, deluded thoughts naturally disappear into the midst of the Unborn.”

He also says:

“In the mind you are born with there is neither delight nor anger; there is only the wondrous Buddha Mind that illuminates the myriad things. To fully understand and trust this principle, without clinging greedily to anything at all, is what I call faith.”

Regarding mental time travel and awakened mind, he says:

"Unable to remain just as you are in the Unborn Buddha Mind, you raise various thoughts, regret what is behind, and worry about what lies ahead; and truly, during the course of a single day, unknowingly and unintentionally, exchanging it this way and that, thought after thought you change the Buddha Mind, and so you have no peaceful day."

Having looked at the mechanisms of emptiness that dissolve the perceived own-being identities of objects in our minds, let's next look at how Buddha Nature changes our experience of perception.

Awe / Numerousness Awareness

In the *Anguttara Nikāya* ("Book of Ones", AN 1.51) the Buddha says

"This mind, monks, is luminous, but it is defiled by incoming defilements."

In the *Essential Dharma of Mind Transmission* the Zen Master Huangbo Xiyun says:

"This numinous awareness-nature (靈覺性), since beginningless time, is as ageless as empty space. It has never arisen and has never ceased ... Buddhas, bodhisattvas, and every living sentient being share this same nature of Great nirvāṇa (大涅槃性). This nature is mind; mind is Buddha; Buddha is Dharma."

The scholar and Zen Master Zongmi says:

"The essence of mind, abiding nowhere, is numinously aware and never obscured."

And:

"The mind that is empty and quiescent is numinously aware and never darkened."

It is not often talked about, but the Buddha-mind is not just about the alteration and transformation of the cognitive mechanics that end suffering,

it is also about waking up to the wondrous nature of the universe that is sometimes hiding in plain sight. This wondrous nature is called *lingjuèxìng* (靈覺性) in Chinese and can be translated as “the inherently aware, responsive, and spiritually luminous (numinous) nature of mind”. Numinous can be defined as having a mysterious, sacred, spiritually charged, or awe-inspiring quality.

I would in no way claim that I am anywhere close to being a fully awakened person, but I have been lucky enough to go down the path far enough that I can speak to this numinous quality from firsthand experience to a modest degree. First of all, I would say that subjectively it does not feel like it has the quality of coming from any of the five senses. Or maybe you could say it is a different way information passes through the senses. Perhaps this is why numinosity is described as “mysterious”. Also, I would say from my perspective, it does have a “luminous” quality but not through a sense of sight. This luminousness is very hard to explain and is actually quite ineffable.

Overall, the experience of the numinous nature of reality it feels to me like “going home” and like the true state of the universe. It seems outside of time. When the Buddha says nirvana is blissful, I suspect he is speaking of this type of phenomenon, though I would not say that it feels like the normal emotion of bliss. It is not a feeling tone.

A hint of this kind of experience can be found in moments of profound awe brought about by experiences like dramatic scenes of nature or music. One study¹⁷¹ of awe performed brain scans of participants while they watched videos designed to evoke awe, positive emotion, or a neutral state while either becoming absorbed in the scenes or analytically being aware of perspective changes. Awe-inducing videos produced less activity in several regions associated with the default mode network¹⁷² than would normally be expected during passive absorption. Participants also reported feeling a smaller sense of self during awe. The researchers concluded that awe may reduce self-reflective awareness by drawing attention strongly outward and immersing people in perceptually vast experiences.

It seems somehow perverse to reduce what is essentially a spiritual experience to neuro correlates, but it helps me to remember that these neuro correlates don’t explain the source of the luminous nature of mind, only that which might keep it hidden in plain sight. Also, I believe what is being

¹⁷¹ See (van Elk, Arciniegas Gomez, van der Zwaag, van Schie, & Sauter, 2019)

¹⁷² posterior cingulate cortex, angular gyrus, and frontal pole

uncovered in moments of numinosity is direct experience of what we earlier called the “essential self”. The essential self does not explain how consciousness itself is created but rather where it somehow connects with it.

One last thing is that from the perspective of numinous awareness, the distinctions of the world seem to flatten creating a sense of what really seems apt to being called “oneness”. To be clear, I am not saying that it is a type of oneness where one thing merges with another. It is not an experience of the “separate self” merging with the cosmos. The oneness is not a thing to perceive. It is more like a purity of perception without a conceptual dualistic filter. It might also be what Huangbo was pointing to when he talks about One Mind:

The buddhas and all sentient beings are nothing other than One Mind; there is no other dharma. From beginningless time this mind has never been born and has never ceased. It is not blue or yellow; it has neither form nor appearance. It does not belong to existence or nonexistence and cannot be reckoned as old or new, long or short, large or small. It surpasses every limitation, name, trace, and opposition. Just this, in itself, is it. The moment you give rise to conceptual thought, you depart from it. It is like empty space, without boundary and impossible to measure.

This One Mind alone is Buddha, and there is no difference between Buddha and sentient beings. Yet sentient beings attach themselves to appearances and seek outwardly. The more they seek, the farther they lose it.

22 - AWAKENING (BODHI/SATORI/KENSHO)

In my mid-twenties I was attending a meditation retreat (sesshin) at a Zen center in the San Francisco Bay area. It was the last day of the retreat, and I went into a private practice interview with my teacher. I had recently settled into my practice at the center and had become more integrated into the official roles in the community. I had a year of monastic practice under my belt from a few years earlier and attended sesshin all over the San Francisco Bay Area as often as my schedule allowed. I was pretty serious about my practice. At the same time, without really realizing it I started gaining a degree of pride because of my perception of myself being “an advanced practitioner.” Looking back, it’s clear that part of my unconscious motivation in practicing was to be admired by other people. I wanted people to recognize that I was as advanced a practitioner as I perceived my practice to be. That certainly included my teacher. I wanted her to be proud and impressed with me. Heading into that meeting I was tired, cranky and maybe feeling a little emotionally aversive. I did my bows and sat down in front of her in the little interview room. “How are things going?” she asked me and since I wanted her to see me as a “successful practitioner” who could not possibly be doing poorly, I answered, “great!”. She looked at me knowingly, said “ok”, and rang her little bell to dismiss me. Usually, the meetings took minutes. She dismissed me after about five seconds.

I walked back to my cushion feeling totally embarrassed. It seemed she had seen right through me and the perverse motivation of practicing to be “liked” suddenly became apparent to me. Don’t get me wrong, I also practiced for more pure reasons as well, but this attempt at being respected had been stealthily polluting it at the same time. I sat down embarrassed and dejected. For the rest of the sesshin that day, I just sat there, not even trying to meditate. I truly gave up.

The next day was a Monday, and I attended the regularly scheduled meditation session before work. While I was sitting there, I felt like an iceberg of emotion broke off from my being and floated away. I am not normally a crier, but all of a sudden, a huge wave of joy and sadness overwhelmed me, and I had tears flowing from my eyes and dropping into my lap. I felt refreshed and relaxed after the sitting and said goodbye to my teacher who was heading to Europe for six months for a teaching tour.

Pretty much as soon as I got to my truck and started driving to work, the skies opened up and a violent torrent of rain started falling. As I was driving on the freeway, I had very little visibility; almost none. Between residual samadhi from the session, the emotional release from the morning sitting and having the deep focus required to stay alive when driving without being able to see the highway, my mind was pretty taut and vibrant. Finally, I got to my exit and turned off the freeway and as soon as I started driving down the offramp the rain stopped and I looked up at the sky and shafts of sunlight were bursting through the clouds. I know it sounds like I am making it up, but that is really what happened. At the same time, I had some thought about Dogen and original enlightenment; I can't remember exactly what, and all of a sudden, a silent explosion of luminosity burst out of me and obliterated the universe. The saturation of the luminosity was so intense it momentarily erased all distinctions of everything. I had had "non-dual" and "no self" experiences before, but this was different. Instead of a merging of self and other or some disappearance of self, in this case EVERYTHING was momentarily gone. It was like a brilliant nothingness.

In the immediate aftermath of this luminous upwelling, I sat there at the stop sign at the end of the offramp marveling at the intense (and I mean intense!) purity that everything had. The whole universe felt free, vibrant and sacred. It was like a filter had been removed. I remember thinking, "there can be no problems" because everything had an infinite ultimate oneness to it and thus could not disturb anything in the mind. It felt like everything had always been this way but somehow, I had forgotten it. I started driving down the road towards the office building I worked at and at that point I think my mind started reassembling and I thought, "Holy shit! I just had an enlightenment experience!". I remember being amazed that I didn't have to try and control my thoughts. I could think freely with no friction at all. I remember sitting in my little truck in the parking lot thinking "Now that I am a Buddha, I need to save all beings"; which is kind of embarrassing in retrospect. I remember being so relieved that enlightenment was a real thing. At this point feelings started coming back on line and I felt an incredible bliss. I was so happy that I actually twirled around in joy as I was walking down the hall to where my desk was. I got to my cubicle and pretty soon

I had a small crowd of people standing around and looking at me apparently being drawn to my vibe. One of my work friends asked me, “What happened to you? Did you get laid?” I spent the rest of the day cleaning my cubicle and other areas near it.

I have been fully enlightened ever since.

Just kidding. This little story did not have a short-term happy ending. Slowly, over the next few days my judging mind slowly started coming back online. At first, I tried to pretend it was not happening, but after a few weeks it was undeniable: I had been kicked out of paradise. I was bewildered because the way of being that I saw was clearly the obviously better way to live if the criterion is “not suffering”. In some ways I felt I was worse off than before the opening because now I had “heaven on earth” to compare my “regular” life to. What I didn’t realize at the time was that a very important seed had been planted in me. It took a while to sprout in and begin to grow, and it’s been an ongoing process that continues to this day. I am still very much a work in progress, but I can now see how I had an overly dualistic view of awakened and non-awakened in the aftermath of my experience.

Terminology of Awakening

Nirvana, emptiness and Buddha-mind speak to what the experience of a liberated existence is while “bodhi” references the catalyzing transformation that gives access to that liberation. Bodhi literally means “awaken”, “to awaken” or “awakening”. In Chinese it is called *puti* (菩提) and in Japan it is called kensho (見性) or satori (悟り). Kensho means “see nature” and satori means “realization”. Additional English terms might be enlightenment, openings and awakening. In the West, some teachers might use the term kensho to reference shallow awakenings and satori for deeper awakening but that is not the traditional usage. The founder of Soto Zen Dogen Zenji did not like the word “kensho” because he thought it was dualistic. For that reason, kensho is rarely used in a Soto context.

What Happens at Awakening

In the Early Buddhist suttas, the component of awakening that most matters to our naturalistic focus is cessation of the intoxicating survival drives which in turn leads to the cessation of greed hate and delusion of Nirvana. There is also mention of craving being destroyed by the act of

awakening. The Early Buddhist suttas also explain that when one awakens there is clear apprehension of the fact that liberation has been obtained. An example of this is in this common formula that is found in the suttas:

"When it was liberated, there was the knowledge: 'It is liberated.' I directly knew: 'Birth is exhausted; the holy life has been lived; what had to be done has been done; there is no further coming to this state of existence.'"

Another aspect of awakening that we can glean from the Early Buddhist texts is that there is a model called the "four stages of awakening" that describes what elements of cognition are shed during successive parts of the path towards awakening. The last element of cognition that is shed before full awakening is ignorance. Ignorant of what? The Early Buddhist suttas say ignorant of teachings such as the four noble truths, but that does not really scratch the itch for a Zen practitioner. In Mahayana it is ignorance of the true nature of reality which is that that all things are non-dual and empty of inherent own-being. In short, it is realizing emptiness. If we add this to our definition, we now have realizing emptiness and destroying the intoxicating survival drives. In fact, ignorance is formally one of the intoxicating survival drives (asavas).

In Early Buddhism, there is no difference in the nature of awakening between the Buddha himself and the awakening of his students (arhats). In Mahayana Buddhism that is not the case. At some point, the Buddha was promoted beyond being a normal human and made into a cosmic celestial being with omniscience. This required the definition of an awakening that was beyond that of a mere arhat. These teachings say arhats drop greed, hate and delusion (*kleśāvaraṇa*) and Buddhas also drop cognitive obscurations (*jñeyāvaraṇa*) that are mental elements that block omniscience. This two-level scheme is barely mentioned in Zen Buddhism and when cognitive obscurations are mentioned they seem to have one of two different meanings. One meaning seems to essentially be the equivalent of "book learning" and is used as a criticism indicating excessive scholasticism. The other meaning seems to be the equivalent of dualistic conceptualization. In light of those definitions, the naturalistic view of awakening being primarily about realizing emptiness and the destruction of the intoxicating survival drives still seems the best working model of what we will try and find neural correlates for.

As we saw in the previous chapter, Mahayana eventually developed the Buddha-nature teachings. The idea is that at the moment of awakening, Buddha-nature is uncovered.

Bodhi and the Asavas

When we use the phrase “intoxicating survival drives” as a descriptive translation for the asavas, what is built into that translation is the idea that responding to pleasure rewards or being cognizant of dangers of survival are not inherently problematic in themselves. You need those for, well, survival. To see how other cognitive systems might corrupt them in a problematic way, let’s revisit the *Sabbāsava Sutta* (“*All the Intoxicating Survival Drives Discourse*” – MN 2) where the Buddha says:

Take a [practitioner] who, using attention skillfully, lives restraining the faculty of the [senses]. For the distressing and intoxicating survival drives [asavas] that might arise in someone who lives without restraint of the [sense faculties] do not arise when there is such restraint.

And:

“Because of putting unskillful attention to what they should not and not putting skillful attention to what they should, unarisen intoxicating survival drives arise and intoxicating survival drives defilements grow.

This is how they apply unskillful attention: Did I exist in the past? Did I not exist in the past? What was I in the past? How was I in the past? After being what, what did I become in the past? Will I exist in the future? Will I not exist in the future? What will I be in the future? How will I be in the future? After being what, what will I become in the future?’ Or they are undecided about the present thus: ‘Am I? Am I not? What am I? How am I? This sentient being—where did it come from? And where will it go?’”

These usages give a pretty clear indication of what happens to create intoxicating survival drives. In the first excerpt, the advice to “restraining the faculty of the [senses]” refers to not letting the mind uncontrollably spin off into self-related thinking as a result of sensory experience. In the second excerpt the advice is to have control of attention and not let it spin off into self-referential rumination. In both cases they are describing what is correlated to an out-of-control default mode network obsessing about survival and pleasure (which itself is a proxy for ‘this will help me survive’).

In the Early Buddhist texts, the destruction of the asavas is said to occur at the moment of awakening:

“Here a monk, through the destruction of the āsavā, in this very life directly knows, realizes, enters, and remains in taintless liberation of mind and liberation through wisdom.”¹⁷³

At some level it would seem that the shift of awakening involves some sort of profound change in the functioning of the default mode network that keeps it from uncontrollably ruminating or worrying about threats to experiencing pleasure or perceived survival threats. We saw in the Buddha-nature (Bussho) chapter that the ongoing mind trait that makes not getting caught by own-being possible is driven by lower functional connectivity in the default mode network. Presumably the experience of awakening involves the transformation of the default mode network from a more connected state to a less connected state in a persistent manner.

Seeing, Realization and Non-dual Liberating Wisdom (Prajna)

From the earliest days of Buddhism, the experience of awakening has been said to include an explicit apprehension of the fact. From the *Dhammacakkappavattana Sutta* (“Turning the Wheel of Dhamma Discourse” - SN 56.11) the Buddha says:

“As long as my knowledge-and-vision of things as they actually are concerning these Four Noble Truths was not completely purified, I did not claim to have awakened to unsurpassed perfect awakening.

“But when my knowledge-and-vision of things as they actually are was completely purified, then I claimed unsurpassed perfect awakening.”

Looking at it from a Zen point of view, when the suttas say the Buddha realized the Four Noble Truths at awakening, I assume this means that at that moment he realized what had kept him from awakening and what had worked for him to set the stage for that awakening. Another example in the

¹⁷³ DN 28, Sammasambodhi Sutta

Early Buddhist teachings of apprehension accompanying awakening is found in the *Mūlapariyāya Sutta* ("The Root of All Things Discourse" - MN 1):

"Monks, a monk who is an arahat (fully awakened person), whose intoxicating survival drives are destroyed, who has lived the holy life, done what had to be done, laid down the burden, reached his own true goal, completely destroyed the fetters of existence, and is liberated through absolute knowledge, he directly apprehends form simply as form. Having directly apprehended form as form, he does not conceive of form, he does not conceive himself in form, he does not conceive himself coming from form, he does not conceive 'form is mine,' and he does not take delight in form. Why is this? Because of the destruction of delusion (and greed and hatred), he is entirely free of delusion (and greed and hatred), I declare."

From Mahayana, we can see this sort of teaching in the *Mahaparinirvana Sutra*:

"Living beings are the same. Although they possess Buddha-nature, they cannot see it because they are covered by desire, anger, and ignorance. They do not recognize the Tathāgata's hidden treasury, just as the wrestler believed that his jewel had been lost. The Tathāgata declares that all beings possess Buddha-nature just as the physician shows the wrestler his jewel. Beings are covered by innumerable afflictions and therefore do not recognize Buddha-nature. When the afflictions are exhausted, then they directly know it clearly, just as the wrestler sees the jewel clearly in the mirror."

From Zen's Platform Sutra we have these teachings on this topic:

"If you do not recognize your original mind, studying the Dharma is useless. If you recognize your own original mind and see your own fundamental nature, you are called a great person, a teacher of gods and humans, a Buddha."

And also:

“Good friends, when there is no awakening, Buddha is a sentient being. When there is awakening in a single thought, the sentient being is Buddha.

“Therefore, understand that all the myriad phenomena are entirely within one’s own mind. Why not suddenly see, from within your own mind, the fundamental nature of true suchness?

“The Bodhisattva Precepts Sutra says: ‘Our original fundamental nature is itself pure. If you recognize your own mind and see your nature, you all accomplish the Buddha Way.’

“The Vimalakīrti Sutra says: ‘Suddenly and completely opening, one recovers the original mind.’

“Good friends, when I was with Master Hongren, I heard his words only once and immediately awakened. I suddenly saw the fundamental nature of true suchness.

All of these excerpts show an undeniable pattern of awakening accompanying a clear moment of conscious apprehension. The first thing worth pointing out is that whatever is being apprehended here is not conceptual. An awakening experience will very likely provide you with philosophical or psychological insights. This might alter the belief system of your identity self. These types of results that can come from an awakening experience would be incidental, however. The deeper changes that really transform lives would be more mechanistic. The transformations of awakening do not come from a change in your thoughts but rather how the brain deals with thoughts in general. Another point to consider is that the presumably relevant neuroplastic change from the awakening would be a reduction in the connectivity within the default mode network. Looking back at the Buddha-nature (Bussho) chapter, a default mode network with lower internal connectivity is a key mechanism of the trait-like condition under which beliefs about an object’s perceived own-being do not stick to the mind and as a result there is no clinging and suffering.

Regarding the idea that an awakening must include an apprehension component to make a difference, there are two ways this can be viewed. The first perspective is that throughout Buddhist history, there has been a widespread mistake of confusing correlation and causation. It is theoretically

possible that the transformations in default mode connectivity are happening regardless of the awareness of the awakening experience, but since there is an awareness of it, there is a mistaken assumption that the seeing caused the transformation rather than the other way around.

The second perspective is that there really does need to be an apprehension to bring forth the transformation of awakening. In that case a subconscious change would not be enough to be awakened. But what does “seeing” really mean here? Obviously, it is not something we see through our eyes or any of the other five senses. It is probably more a matter of the manner in which perception occurs. Specifically, it’s probably the mind noticing that reality is not being perceived in the same manner as it normally is. I can tell you for certain that when I have had moments of radically altered self-perception, it was noticed. Even in moments where I felt “self” vanish, there was still somehow a recognition of it. I watched people have bad psychedelic trips when their sense of self disappeared and they thought they were dying. Obviously, there was recognition of lack of self somehow even though there was presumably no one to notice it.

I can dive a bit into my own experience here and explain why I think apprehension is actually important. In my life, the first brief views into emptiness were important because they became a beacon that my cognition could orient towards. I mentioned in the above story of my first little awakening experience that at some point in days that followed my judging/discriminating mind slowly came back online and eventually it seemed fully back. I noticed that as it came back, there was a corresponding increase in my suffering. Having my normal sense of self come back was pretty disappointing at the time, and I felt like everything that had positively changed with the opening had gone away. I was wrong though.

I had actually gained something very important and that was prajna (non-dual wisdom). I had experiential episodic memories of what it was like to experience reality with no discrimination. I could recognize it if that perceptual perspective arose again. The first thing I noticed was that after the opening experience, the nature of my zazen changed. Now when I sat, a combination of a sense of numinous reality combined with non-discrimination would occasionally rise up unbidden. Each time it happened it would move my attention away from my own narrative story as it no longer had the same weight. Since I had episodic memory of it happening earlier, I could notice when it happened again. From my perspective of life, I feel this combination of numinous awareness, non-discrimination and diminished self-referentiality is the non-dual awareness of Buddha Nature or True

Nature. This prajna is not being wise regarding some concept; it is being wise about a way of perceiving. That is an incredibly important distinction.

The Heart Sutra says:

“a bodhisattva relies on prajña paramita (perfection of wisdom)...All buddhas of past, present, and future rely on prajna paramita”.

As I would go through my life, it was easier for me to notice when I was trapped in the conceptualization->craving->clinging->suffering cycle because it stood out more starkly in comparison to the non-dual wisdom of Buddha-nature. Perhaps this is kind of a dumb analogy but if you have a good night's sleep and feel rested, you can better notice in the future when you are not getting enough sleep and feel tired due to the contrast with the memory of feeling rested. In Mahayana Buddhism, there is the concept of the paramitas which are areas of practice that can be worked on and “perfected” and include elements like generosity, effort, patience and virtue. Look at this excerpt from the *Aṣṭasāhasrikā Prajñāpāramitā Sūtra* (*Perfection of Wisdom in Eight Thousand Lines*) where the Buddha explains what role prajna plays:

*“The perfection of wisdom is supreme because it gives direction to the other five perfections. The other five practices become true perfections when wisdom directs them toward complete awakening. For this reason, the **perfection of wisdom controls, guides, and leads the other five perfections**. In this sense, the other five are contained within the perfection of wisdom, and to fulfill the perfection of wisdom is to fulfill all six perfections.”*

There is also the general sense of Buddha Nature having a gravitational pull. The desire to align with it feels like an unconscious motivation to align and be in accord with it. I think the mechanism behind this is that the motivational machinery in the subcortical brain can notice that cognition revolving around Buddha-nature is associated with periods of better feeling, so an incentive salience develops that propels us. Of course, this can be elaborated upon by narrative self and become a source of craving and grasping and we have to be mindful of that, but the underlying pre-cognitive pull towards attunement with true nature is actually quite helpful and wholesome.

Perhaps for someone who has a truly complete awakening in a “one and done” fashion like the Buddha, the recognition factor is not important, and

it becomes more of an “oh wow, look what life is like now!” scenario. For the rest of us, the episodic memory of a non-dual and empty way of perception becomes crucially important because it guides and orients our practice.

The idea that practice is necessary after some degree of awakening has a long history in Mahayana Buddhism. For example, *The Śūraṅgama Sūtra* (“Heroic March Discourse”) says:

“As for principle, awakening is sudden; through that awakening, delusion is dissolved. But the conditioned actuality is not removed suddenly; its causes are exhausted in sequence.”

The medieval Chinese Zen master and scholar Zongmi wrote:

“Although one has completely and suddenly awakened, deluded attachments formed over many ages have become ingrained habits and cannot suddenly be exhausted. Therefore one must practice against those habits and bring oneself into accord with the original nature.”

One of the most important formulations in Zen is a map of awakening and practice called the Five Ranks. Attributed to the 9th century Zen master Dongshan Liangjie, this framework maps the stages of cultivation of awakening by exploring the relationship between the Absolute (ultimate reality revealed through awakening) and the Relative (our normal everyday experience of reality). This relation is examined across five progressive stages that begin with the Absolute hidden within the Relative and culminating in their complete undivided integration. The goal of the ranks is to describe the path that leads us past dualistic thinking to realize that profound awakening is experienced entirely within ordinary daily life without distinction. I am still progressing along this path, but at any given moment, except when I am very angry it seems, I can notice the functioning of the absolute within the midst of everyday life if I pay attention. Often it comes unbidden. But the fact that I still notice the distinction relative and absolute shows that my work is far from over.

I mentioned earlier in this section that the first cultivation/integration experience I had after my first modest awakening experience was that I noticed a change in what zazen felt like in the aftermath. After the opening, zazen could feel like it was a manifestation of the perceptual truth that had been uncovered during awakening. Interestingly, there is a study that might

show the neuro correlates of this. In the 2019 study¹⁷⁴, researchers gave experienced meditators psilocybin during a five-day meditation retreat and measured their brain activity before and after the retreat. During the psychedelic session, some participants experienced strong oceanic self-boundlessness, which they describe as a positive form of ego dissolution in which the usual boundary between self and world becomes less distinct. When the participants later practiced open-awareness meditation without psilocybin, those who had experienced the strongest oceanic self-boundlessness showed the greatest reduction in communication between the medial prefrontal cortex and posterior cingulate cortex which are two major regions of the default mode network. Remember that the trait disposition that drives decentering is mediated by this decrease in default mode node connection. The relationship between the intensity of the earlier loss of self-boundaries and the degree of reduction in default mode connection during meditation was significant. This points to the idea that the self-dissolution experience may have altered how easily the meditators could recreate the experience during meditation.

This begs the question regarding whether there is anything similar regarding the non-dual experiences someone can have during psychedelics and a “natural” awakening experience. As someone who has had both, I have an opinion on the matter. I think *some* psychedelic experiences can have characteristics that are shared with sudden awakening. For example, both can temporarily reduce or turn off the perception of self-existence. Both can uncover the experience of emptiness and show that objects of perception are free of own-being. Lastly, both can uncover the numinous quality of perception we explored earlier. That said, psychedelics do it in a murky manner whereas a natural awakening experience feels significantly clearer and purer. It’s a huge difference actually. Psychedelic-driven “opening” experiences feel more like intimations than natural awakenings do. That said, I think they are similar enough to draw inferences. Plus, it is all we have from an experimental perspective. The chance of someone experiencing a sudden awakening experience when hooked up to a brain scanner is probably a billion to one.

For what it is worth, I am not the only one who thinks the two experiences can be analogous. The Soto Zen priest and teacher Kokyo Henkel has a document entitled *“How Buddhist Practice Might Benefit Psychonauts and how Psychedelic Practice might Benefit Buddhonauts”* and in it he writes:

¹⁷⁴ See (Smigielski, Scheidegger, Kometer, & Vollenweider, 2019)

Psychedelics can provide a direct taste of the absence of separate self (or sacred purity of the ordinary world) to short-or long-term practitioners who haven't yet accessed this verification or have forgotten it. Awakening is a radical shift of perspective, opening up new insight – not merely calm-abiding; with a higher dose of psychedelic something will surely shift.

One last thing I would like to discuss in terms of realization is depth of realization. On one end of the spectrum is the complete awakening of the Buddha, or at least as modern Zen sees it. This deep and profound awakening usually has the subjective experience of feeling like consciousness is turned off and on almost like the rebooting of a computer. In Zen literature it is sometimes called the “great death”. This is probably what Dogen experienced when he said he “dropped body and mind”. This type of awakening produces the deepest realization and gives a full experiential comprehension of emptiness. Having this experience doesn’t mean you are “done” though. You still need to work on conditioned habitual patterns just like anyone else, you just have the best possible tools to do so.

On the other end of the realization spectrum, there are perhaps what could be called intimations. They are usually not fully formed and more have an intuitive sense of numinous awareness, non-discrimination and diminished self-referentiality. In terms of Japanese-style koan curriculum study, some teachers feel this is enough to work on it, and some want a deeper understanding first. Having seen examples of both, I think both approaches have their pluses and minuses but are both valid paths.

Sudden Awakening

The awakening experience can often come on suddenly, but what actually triggers it and what is the mechanism? Since there is essentially no chance of catching a genuine sudden awakening in a brain scan, at least for the time being, the best we can do is put forth some possibilities.

One theory is put forth by neurologist James H. Austin in a paper¹⁷⁵ that argues that Zen meditation gradually prepares the brain for awakening by training two complementary forms of attention: deliberate concentration and an increasingly open, receptive awareness that notices events without immediately filtering them through ordinary self-centered concerns. He

¹⁷⁵ See (Austin, 2013)

proposes that this training changes the balance between brain processes that represent experience in relation to oneself and those that represent the surrounding world more impersonally. Under the right conditions, an unexpected sight, sound, or other event could suddenly seize attention and activate inhibitory cells in the thalamic reticular nucleus. Remember the thalamus is the subcortical brain region that routes sensory data and other information around the brain and plausibly is part of the mechanism that creates conscious experience itself. Austin hypothesizes that this sudden activation of the thalamic reticular nucleus could temporarily suppress parts of the dorsal thalamus involved in maintaining bodily and psychological aspects of selfhood. The result would be an abrupt disappearance of much of the normal “I exist” awareness while perception of the surrounding world remains unchanged.

Another possible mechanism can be considered if you accept the premise that psychedelics can sometimes produce “awakening-like” experiences. If that is true, there might possibly be similarities in how they are activated. To set the stage for this hypothesis, let’s first consider what the mechanism of psychedelic activation is. One 2010 paper describes how “classic” psychedelics such as psilocybin, DMT and LSD create the psychedelic experience. As it turns out that all of these chemicals are shaped somewhat like a key neurotransmitter called serotonin. There are different types of serotonin receptors in different parts of the brain. One is called the serotonin 2A receptor and they are mostly found in the cerebral cortex which would include the default mode network. The serotonin shaped classic psychedelics fit into these receptors especially well. Activating these receptors changes the activity of a type of brain cell called cortical pyramidal neurons. Activating these cells increases excitatory neurotransmitter signaling, which in turn alters communication through brain circuits involved in perception, emotion, and higher-level thought. This alters the normal balance and coordination of interconnected cortical and subcortical systems which causes them to process sensory information, emotions, and internal thoughts in unusual ways. One of those ways would be attenuation or dissolution of self. The authors also propose that excitatory neurotransmitter signaling changes may promote neuroplasticity, which could help explain why psychedelic experiences can sometimes produce effects that persist after the drug itself has worn off.

Knowing how this mechanism works it is possible to wonder if the brain produces its own natural psychedelic that can trigger a psychedelic-like experience. It turns out the DMT can be found in the human brain¹⁷⁶. There

¹⁷⁶ See (Barker, McIlhenny, & Strassman, 2012)

was a book that came out called “God Molecule” that oversold the idea of natural DMT in the brain, and it hurt the credibility of the theory, but if you look past this, there are some intriguing papers in subject. One paper shows that DMT is a naturally occurring substance in mammals, including humans, and studies have detected it in human blood, urine, and cerebrospinal fluid. The enzymes needed to synthesize it have been found in human brain tissue. Stronger evidence comes from rats, where researchers¹⁷⁷ directly measured DMT being produced and released in the cerebral cortex. This makes it plausible that endogenous DMT has some normal signaling or regulatory function in the mammalian brain, and some researchers have proposed that it might act as a neurotransmitter or neuromodulator¹⁷⁸. What we don’t know is if the human brain ever produces enough DMT to generate a psychedelic experience. It is also possible that other naturally occurring psychedelics exist in the brain, but we just don’t know what to look for. It is an intriguing possibility.

One thing that is notable is that prior meditation experience is important in both of these proposed mechanisms. The James H. Austin theory starts with the premise that meditation practice can prime the thalamus for awakening. When it comes to the “brain-produced psychedelic” theory, we have some interesting evidence we can look at. In one study¹⁷⁹, they detailed how a group of experienced meditators and a group of newbie meditators both attended the same meditator retreat. At that retreat, both groups were given a strong dose of psilocybin. The experienced meditators were significantly more likely to have an “ego dissolution” experience than the newbies. And among those from both groups who experienced ego dissolution, the experienced meditators were less likely to experience “anxious ego dissolution” which is a fancy way of saying “they had a bad trip”. It’s clear from 2500 years of anecdotal reports that meditation primes the brain for awakening and if either of these theories are close to the mark, we can see why that might be the case.

Continuous Awakening

So far, we have looked at awakening in terms of a sudden breakthrough followed by cultivation but there are models of awakening as well. One perspective is that awakening is not an event but something that is available at

¹⁷⁷ See (Dean, et al., 2019)

¹⁷⁸ See (Jiménez & J. Bouso, 2022)

¹⁷⁹ See (Smigielski, et al., 2019)

every moment. Some call it gradual practice and some call it continuous practice. Dogen Zenji, the founder of Soto Zen in Japan, is considered the standard bearer of this type of practice. For example, he writes in an essay called *Bendōwa* (“A Talk on Practicing the Way”):

To think that practice and realization are two separate things is the view of those outside the Buddha Way. In the Buddha Dharma, practice and realization are one and the same. Because our practice even now is practice grounded in realization, the beginner’s practice of the Way is itself the whole of original realization. Therefore, when we are instructed in how to practice, we are taught not to wait for realization somewhere outside of practice. Practice itself directly manifests original realization. Because it is the realization of practice, realization has no end; because it is the practice of realization, practice has no beginning.

It is easy to interpret this to mean that practice is not a means towards awakening but is awakening itself. Some people argue however that the view expressed in this essay is the view *from* awakening and not instruction for practice. There is prior historical precedent for the “each moment of practice is a moment of awakening” perspective in Chinese Zen. For example, Mazu Daoyi taught:

“The way (道) does not need to be cultivated; only do not defile it. If you wish directly to comprehend way, ordinary mind is the way. Just now, walking, standing, sitting, lying down, responding to circumstances and dealing with things: all of it is the way.”

One modern lineage that is well known for having teachings about not seeking for or needing an instantaneous awakening in practice is that of 20th century Soto Priest Kodo Sawaki. Here is one of his quotes:

“My teaching needs no satori (awakening); there is no satori (awakening). I don’t whisper this. I say loudly: ‘There is no satori (awakening)!’”¹⁸⁰

¹⁸⁰ This and all other Sawaki quotes are from Zen Talks on Antaiji’s website.

Despite that blunt statement, it is important to see it in the context of statements like:

"What we call satori is not something far away."

And:

"Truly, practice itself is satori itself."

And:

"We don't practice in order to get satori. It's satori that pulls our practice. We practice, being dragged all over by satori."

With these quotes in mind, I think an accurate reading of this understanding of teaching is not that awakening is not important, rather it is that it is actualized through Zazen. There are three modes of "gradual/continuous" practice we can look at: one without realization, one with realization and one that works directly with daily life.

We will first look at "gradual/continuous" practice without realization. What might be the neuro correlates of awakened-mind without the recognition of emptiness that can come with sudden awakening? If we look back to the Buddha-nature (Bussho) chapter, we saw that the neuro correlate of being able to reliably "decenter" was a default mode network with lessened internal connectivity. Regular meditation with no sudden awakening event will, over time, lessen the internal connectivity of the default mode network. So, if you meditate hard enough and long enough, even if it does not produce any "non dual" states, I don't see why they could not theoretically get to the same spot that sudden awakening with gradual cultivation gets you. Perhaps one challenge is that it is not possible to get as far as you would without the "recognition" of awakening in a short human life, but certainly you could get pretty far and greatly improve equanimity and resilience in life. This can happen with any type of meditation, but let's next look at a special quality of open monitoring meditation. This is the type of meditation most commonly practiced within "gradual/continuous" lineages.

If the Meditation (Zazen) chapter, we looked at the Japanese study on open monitoring meditation. The most relevant discovery from that paper was that in open monitoring meditation, there was reduced connection between the striatum and the default mode network's autobiographical memory regions. The researchers interpreted it as detachment from

autobiographical memory. Autobiographical memory is key to the workings of the narrative self. With an attenuated narrative self, craving, grasping and suffering will also be attenuated. In real time. What is amazing about that study is that the subjects were all brand new meditators. Even as novices, a significant number of them were having immediate reduction in self-referential processing. From the perspective of this study, “practice and actualization are the same thing” is not just a poetic phrase meant to be inspirational. The more often and the more thoroughly that open monitoring mindfulness is maintained, the less someone will experience craving, grasping and suffering in those moments. This approach to practice is not something that is working towards something else, its real-time working is the goal itself. This is remarkably similar to what shikantaza is often described as.

So that is “gradual/continuous” practice without “realization”, but how about “gradual/continual” practice with “realization”? If we go back to why the realization/recognition/seeing aspect of awakening is important, it is because once set, it acts like a beacon to align and orient our minds to. The important characteristics of what is “seen” and thus what becomes prajna are numinous awareness, non-discrimination and diminished self-referentiality. To revisit the Meditation (Zazen) chapter again, In the 2024 Israeli study we looked at, forty-six meditators were asked to try to deliberately dissolve their sense of being a self while doing open monitoring meditation while having their brains scanned. While most of the 46 were able to attenuate some aspects of self-experience, twelve of the participants were able to reach much deeper levels of self-dissolution. These participants who had the deeper experiences had more lifetime meditation hours than those who had more shallow experiences. The deep experiences had subjective qualities like consciousness feeling disembodied and non-locatable in space, subject and object distinctions disintegrating and in two cases, loss of self. In one case, the participant reported encountering an unbounded field of being with no observer and no witness. Those types of experiences sound arguably awakening-like. They lack perhaps the overwhelming and decisive nature of sudden awakening, but they might possibly have the right qualities to set the “recognition” quality of a prajna beacon if there is enough repetition over a period of time. I have personally had random experiences like these, and they did seem to hint at what was to come with awakening, but since I am not the type of meditator that can reliably enter into these types of experiences, my understanding of this modality is just theoretical.

The third type of “gradual/continual” practice is where you focus closely on your reactions to the circumstances of your everyday life. Instead of habitually fleeing from aversive experiences or mindlessly chasing after

pleasurable ones, you stay with the emotions that were driving those impulses. If you engage with life in this manner over a period of time, you begin to gain a non-dual equanimity where you become less of a slave to avoiding discomfort and chasing comfort. You gain the capacity to not lose yourself in worry and rumination when things don't go your way. Through this process, the sense of self and its demands on life loosen and you become increasingly able to accept life as it comes no matter the circumstances. This practice is paired with open-monitoring meditation so you can increase your capacity to become the moment. If you have read any Charlotte Joko Beck, you probably recognize this type of teaching. While her style of using everyday life is similar to the Japanese Zen master Bankei, her specific emphasis on noticing and staying with emotions is arguably a modern type of Zen practice that she developed without any direct historical precedent in Zen. It is similar to some mindfulness instructions found in the Early Buddhist texts.

One relevant study to this type of practice was a 2010 study from the University of Toronto. They studied 36 adults to see whether mindfulness training changes how the brain responds to sadness. Twenty participants completed an eight-week Mindfulness-Based Stress Reduction program, while 16 were assigned to a wait-list control group. After the program ended, participants underwent brain imaging while watching film clips designed to evoke sadness. Both the control group and meditators reported experiencing about the same amount of sadness, but their brains processed the emotion differently. Compared with the control group, meditators showed less involvement of several regions associated with self-referential and conceptual processing, including rear portions of the default mode network. The meditators had greater involvement in body sensation regions like the insula and somatosensory cortex. Greater recruitment of these body-sensation regions was also associated with lower depression scores. The relevance to Joko's style of practice is that attending to emotion with less narrative-self activation seems to be easier for meditators.

Another relevant study is one from 2019 from Yale University that used brain imaging to examine how mindful acceptance changes the brain's response to unpleasant experiences. Sixteen adults with no previous meditation experience viewed negative images and received painfully hot stimulation. Sometimes they were asked to react normally and other times to adopt a simple mindful attitude of allowing their experience to occur without judging or trying to change it. During mindful acceptance, participants reported less negative emotion and less pain. Negative images also produced less activity in the right amygdala and while painful heat produced weaker responses in several brain systems involved in processing pain.

Interestingly, these reductions occurred without noticeable increases in the central executive network which is normally recruited when people try to deliberately control or reinterpret their emotions. The findings suggest that mindful acceptance may reduce the intensity of unpleasant experiences not by mentally talking oneself out of them, but by changing how strongly the experiences are processed as emotionally or physically threatening in the first place.

This chapter is on awakening so you may be asking “where is the awakening in this?” I will let Joko answer in her own words from an interview she gave to Tricycle Magazine. The interviewer asks:

What’s so important about daily practice?

Joko’s answer is:

It isn’t something that we want to do. But that’s what keeps you getting more porous. A lot of people, though, even though their practice is going well, will read a book, and say, “You know, Joko, in the three or four years that I’ve worked with you, everything in my life has transformed. I have a happy marriage now, I’m getting along at work, everything is totally different, and I feel much freer. But what about the real thing?” They mean, “When do I get enlightened?” And of course, they are walking the path of enlightenment—non-reactivity—but their understanding is partial. In time, they’ll see that the process itself is the real thing; it is the gateless gate.

The capacity for great satori—that’s not going to happen to the average person. The person who has a great opening is somebody who has been almost selfless for years, and maybe that last little chunk drops off. I mean, great satori doesn’t just fall out of the skies.

Capping Phrase

I am very grateful that I blundered into the spiritual path of Zen Buddhism during this life. I have a deep appreciation for how this practice has transformed my life and how it continues to do so. I hope that this book’s

exploration of how the mind and practice works can be an inspiration to start or deepen your own practice. At the very least, I hope it was interesting.

RESEARCH AND TRANSLATION NOTES

Buddhist Translations and Sources

Generally, in Western literature, Buddhist terms are either rendered in Pali, the language of Theravada Buddhism or Sanskrit, the language of Mahayana Buddhism. Since Zen is in the Mahayana tradition, I will typically use the Sanskrit version of the terms. There are a few exceptions though. In some cases, like *jhana* (Pali) vs *dhyana* (Sanskrit), I will pick the Pali term because of its wide Western vernacular usage. In rare situations, like in the case of *taṇhā* (Pali) vs *tṛṣṇā* (Sanskrit), the Sanskrit word will have more difficult pronunciation so I will go with the Pali version to make it more readable.

This book makes use of many translations of Buddhist sutras. The sutras (suttas in Pali) that were first composed after the passing of the historical Buddha are often called Early Buddhist Texts. These Early Buddhist Texts survive to this day as the Pali Suttas of Theravada and the Agamas of Mahayana. Generally, if a text exists in one collection there will be a parallel version in the other. They are remarkably similar to each other with only subtle differences in most cases. That being true, I will generally pull Early Buddhist Text translations from the Pali Suttas since those translations are much more accessible from a logistical standpoint.

Unless stated otherwise, all of the translations of Buddhist texts in this book were done by me using the many excellent AI translation resources that have become available in the last few years. Some of the Early Buddhist Text excerpts used in this book start with the open-source translations of Bhikkhu Sujato and then modified as necessary based on insights from the translation tools or a desire to maintain a consistency of terminology throughout the book. We are deeply indebted to Bhikkhu Sujato for making

the Pali sources and his translations freely available and open source on the Sutta Central website.

The Japanese Zen Perspective of this Book

It should be stated early on that all of my training has been done within the context of Japanese derived Zen lineages. I have made an attempt to stay informed about Chinese, Korean and Vietnamese Zen throughout the years but unquestionably my understanding of Zen has been subconsciously molded by practicing in the traditions that I have. I am sure it has influenced my views in ways that I cannot perceive so please take that into account when I make generalized statements about “Zen” in this book.

Along these same lines, most written works in English about Zen have Japanese Zen as the basis and the Japanese renderings of practice terms such as *zazen*, *kensho*, *koan* and *shugyo* are most commonly recognized by Western English language audiences. For this reason, I typically use the Japanese words for Zen terms when they are not translated.

Some Perspectives on Scientific Studies

Very few “answers” in science are considered absolute and irrefutable facts. A hypothesis is promoted to a theory when it is supported by a preponderance of evidence that is rigorously tested through the scientific method. This promotion is not a declaration that the theory is final and irrefutable from that point forward. Often theories will be contested, and different camps will debate the veracity of competing views. In this book I have selected the scientific theories that seem to best map to how Buddhism understands the workings of the human mind. If I write something like “a destabilized default network results in a diminished sense of self” that does not necessarily mean that this is unequivocally settled science. Rather it is a judgement that a theory cleanly and directly explains a facet of Buddhist psychological understanding. There is always the possibility that a different theory emerges that better explains what is being discussed. This is the nature of how science develops.

To make the book readable for a general audience, I have avoided constantly qualifying that what I am currently explaining is just the best fitting theory that I have found at this moment in time. In cases where a theory is more speculative than empirical or when I am choosing between two well-established but divergent theories, I have made an effort to indicate that.

A related point is that science, in general, is experiencing what is called a “replication crisis”. In too many cases it is found that the results of a particular study could not be replicated when the experimental design of the study is rerun. Neuroscience and psychology are certainly not immune to this. In this book I have made a considerable effort to choose, when possible, studies that are supported by other evidence that points to the same conclusion, have been replicated or are replications themselves.

One last point regarding scientific studies is that this book focuses on the Zen Buddhist perspective of practice but many of the meditation studies in this book come from experimental or observational interactions with meditators from other Buddhist traditions and secular mindfulness that is patterned on Buddhist Insight Meditation. Partially this is because scientists have largely used vipassana (and related secular mindfulness) and Tibetan Buddhist meditators so those are simply the studies I have available. Another reason is that I believe two of the main meditation practices that I investigate, focused meditation and open awareness style meditation have characteristics that are the same regardless of what tradition they are found in. Sometimes I would pick a vipassana study over a Zen one because the vipassana one had a stronger experimental design and the underlying processes being explored were the same. The fundamental brain changes that come from meditation are not unique to any one school. Zen practice has its own focus and emphasis (which we will discuss), but it is not a fundamentally different path than other Buddhist paths at its core. Some Zen Buddhists might claim their practice is fundamentally different than what other schools do, but in my mind that is either just marketing or perhaps ignorance of what happens in other forms of Buddhism. Zen differs in how the pieces of practice fit together but the pieces themselves are based on universal Buddhist principles and mechanisms.

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