THESIS

A DEFENSE OF EMOTIONS IN EVOLUTIONARY EPISTEMOLOGY

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ABSTRACT

A DEFENSE OF EMOTIONS IN EVOLUTIONARY EPISTEMOLOGY

Current literature in evolutionary epistemology places a kind of epistemic 'rationality', guided by evolution, as the primary consideration or rationale that directs whether and how we acquire knowledge. Foundational works by the likes of Donald Campbell, Konrad Lorenz, and Sir Karl Popper paved the grounds of evolutionary epistemology by prioritizing natural selection's role within theories of knowledge. By recognizing and understanding the significance of humans' niche within the biological world, it better informs us of the aims of evolutionary epistemology.

My thesis aims to incorporate emotions in the understanding and development of evolutionary epistemology. My arguments stem from the idea that emotions are an innate and biological response that have an epistemically significant evolutionary history while also concurrently conferring epistemic advantages. With much of the current discussion focused on evolutionary 'rationality' sans emotion, there is much left to be desired in evolutionary epistemology: I believe evolutionary epistemology is missing an evaluation and incorporation of our emotional systems that shape and influence epistemic aims. While evolutionary epistemologists allude to emotions' significance and relevance through other causal mechanisms, there is little discussion of how emotions explicitly affect and interact with our epistemic processes. The overall aim of my thesis is to stress the epistemic contribution that emotions would have to the current developments within evolutionary epistemology and its fittingness within the scope of evolutionary epistemology's aims as currently construed.

I first summarize evolutionary epistemology using the works of Campbell, Lorenz, and Popper and explicate what evolutionary 'rationality' entails. Then, I explore some epistemic roles emotions play within important features extrapolated from an evolutionary 'rationality': epistemic fallibility and epistemic creativity. I argue that evolutionary epistemology benefits from an investigation and application of emotions to these features because their role reinforces the same aims that evolutionary epistemology strive to achieve. To wrap things up, I lay out implications and future directions of accepting my defense. I ultimately contend that a more serious consideration of emotions within evolutionary epistemology would only elucidate a fuller comprehension of our naturalized knowledge; not only will we learn more about what human knowledge is construed as, but we will also learn more about how the construction of knowledge, for and by evolved humans, ought to be produced.

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CHAPTER 1 – FOUNDATIONS OF EVOLUTIONARY EPISTEMOLOGY

1.0. Introduction

Since Darwin's contributions to the evolutionary sciences, there has been increased interest in how these evolutionary mechanisms interplay with various facets of human living. One such expansion seeks to understand the evolutionary influences in relation to our knowledge processes; this is what evolutionary epistemology broadly is. Understanding knowledge acquisition under the scope of evolution establishes a framework encompassing other salient features that further characterize what evolutionary epistemology is. In my thesis, I summarize evolutionary epistemology as defined by Gerard Radnitzky and W.W. Bartley in *Evolutionary Epistemology, Theory of Rationality, and the Sociology of Knowledge*. They discuss evolutionary epistemology as fundamentally developed from the works of three key figures: Donald Campbell, Konrad Lorenz, and Sir Karl Popper. While each thinker approaches the topic differently, they have a common thread for how evolutionary epistemology can contribute to theories of knowledge and what it aims to do. In this chapter, I will refer to this book and to Lorenz' *Behind the Mirror* to summarize three features; I designate these three features as evolutionary 'rationality', epistemic fallibility, and epistemic creativity. While there are other defining characteristics of evolutionary epistemology, I think these dimensions give a comprehensive understanding of what evolutionary epistemologists value and the aims of their research program. I also focus on them as I think they best frame my defense of emotions later. I contend that while evolutionary epistemologists discuss emotions, they fail to discuss them as thoroughly as I push for. To start, I will lay out some assumptions and elucidate distinctions within evolutionary epistemology that will better inform us of where my thesis lays within the scope of evolutionary epistemology as currently construed.

First, I will not be concerned about whether the ideas of Campbell, Lorenz, and Popper all cohere together. As mentioned, they have slightly different approaches and condensing their approaches together into a cohesive evolutionary epistemic framework is not the aim of my thesis. Instead, I am summarizing three common features across the thinkers that highlight places where emotions can play a role in the scope of evolutionary epistemology.

I also do not explicitly defend evolutionary epistemology. While it is certainly helpful to be sympathetic towards evolutionary epistemology, it is not necessary to be sympathetic towards it for the sake of my thesis because I am hoping to convince you that emotions should be considered within the scope of evolutionary epistemology regardless of whether you adhere to evolutionary epistemology's axioms or not. Therefore, I am arguing more for emotions' fit in evolutionary epistemology, not for evolutionary epistemology itself. If you are unsympathetic to evolutionary epistemology's axioms, then you can see my defense as more so a defense of emotions within general epistemology. The pressing point is that I argue for emotions' significance in epistemic matters, and my argument could be extended to general epistemic axioms with the stipulation that my argument still fits best as a defense of emotions within evolutionary epistemology specifically.

Next, the general project in evolutionary epistemology is widely characterized in two ways:

> "There are two interrelated but distinct programs which go by the name "evolutionary epistemology." One is the attempt to account for the characteristics of cognitive mechanisms in animals and humans by a straight-forward extension of the biological theory of evolution to those aspects or traits of animals which are the biological substrates of cognitive activity, e.g., their brains, sensory systems, motor systems, etc. The other program attempts to account for the evolution of ideas, scientific theories and culture in general by using models and metaphors drawn from evolutionary biology," (Bradie, p. 403).

I am concerned with the former construal because I place evolutionary mechanisms as fundamental to all knowledge processes within human cognition. As such, I will not be discussing the evolution of ideas or theories in my thesis.

Finally, I derive the aims of evolutionary epistemology from definitions provided by Popper. Popper has discussed the aims of epistemology in a few different ways, and I focus on two formulations from Radnitzky and Bartley:

1. "The central problem of epistemology has always been and still is the problem of the growth of knowledge," (Popper's *The Logic of Scientific Discovery*).
2. "The main task of the theory of knowledge is to understand it as continuous with animal knowledge; and to understand its discontinuity—if any—from animal knowledge," (Popper's *Replies to my Critics* in P.A. Schlipp's *the Philosophy of Karl Popper*).

By continuous and discontinuous, Popper means to highlight how there are underlying common epistemic processes between humans and other organisms, and so an adequate theory of knowledge must illuminate these continuities and discontinuities to some extent. Whenever I discuss the aims of evolutionary epistemology, I frame them via these two definitions.

With these in mind, I hope the following sections give a cohesive and clear sense of what evolutionary epistemology defends and how emotions can neatly fit in this defense. Specifically, Campbell, Lorenz, and Popper establish the foundations of evolutionary epistemology as a system that describes the growth of knowledge via prioritizing natural selection and evolutionary consequences. Within my thesis, this is broadly characterized as evolutionary 'rationality'. From this, certain epistemic characteristics can be recognized and highlighted; I focus on epistemic fallibility and epistemic creativity. Upon establishing these features of evolutionary epistemology, I conclude each section with a brief introduction on how emotions can play an epistemic role within each feature.

1.1. Evolutionary 'Rationality'

A key feature to understanding evolutionary epistemology's framework is an evolutionary 'rationality' derived from a Darwinian theory of natural selection. Evolutionary 'rationality' is the general idea that there are innate and biological motivators that underlie our rationality, and these

motivators are thought to be inherently epistemic in that they influence what we can know and how we know it (Bartley, p. 23). While emotions are an innate and biological response that have an evolutionary history and seem to play a role in human knowledge acquisition and development, their influence is not often discussed within evolutionary epistemology literature. In this section, I introduce my general understanding of what evolutionary 'rationality' is and briefly discuss how emotions contribute to our understanding of it.

According to evolutionary epistemologists, evolutionary 'rationality' is informed by Darwin's theory of natural selection and the implications of applying the theory. For example, Campbell posits that both human evolution and human knowledge acquisition may be understood as having two relevant and common features: both are dependent on a cognitive system that reliably makes sense of the external world, and both entail a process of trial-and-error that re-orients the process in a more efficient manner to achieve a certain epistemic end (Campbell, p. 49). He compares these processes to a computer that is solving a problem as they both vicariously explore the environment and have an aim of being more successful at resolving the issue at hand (Campbell, p. 66). Evolutionary epistemologists argue that, like the computer, evolution itself is a process of knowledge acquisition because of these universally shared attributes that are fundamentally undergirded by evolutionary factors (Radnitzky et al., p. 66).

Another example of applying evolutionary 'rationality' can be seen in Günter Wächtershäuser's theory concerning the evolution of sensory perception. In *Light and Life: On the Nutritional Origins of Sensory Perception,* Wächtershäuser proposes an idea that explains the origins of sensory perception as evolutionarily significant. Specifically, he explains how photosynthesis and locomotion evolved alongside each other to create a new way of acquiring general knowledge: sensory perception. Because photosynthesis and locomotion are evolutionary driven features, it implies that the

influence of evolutionary 'rationality' expands to sensory perception and, thus, knowledge acquisition; this is because sensory perception is the primary mode for acquiring knowledge[1] in humans. In other words, the evolution of our perceptual systems becomes relevant to what we can know and how we know it.

Wächtershäuser begins with describing the origins of life as a nutrient-filled pool teeming with protobacteria. Through passive currents and diffusion, these protobacteria were able to acquire appropriate nutrients to survive (Wächtershäuser, p. 125). When nutrients were depleted, protobacteria were proposed to evolve cilia and flagella, or hair-like structures that created turbulence. Consequently, this created more diffusion of nutrients without the need to move around (Wächtershäuser, p. 125). However, the surrounding nutrients became depleted over time again, and this method eventually became insufficient towards sustaining life. The pressure to seek out nutrients is thought to have catalyzed the evolution of photosynthesis in protobacteria. This granted them a crucial means of internal biosynthesis using the external resource of sunlight when their direct surroundings were depleted of nutrients (Wächtershäuser, p. 125).

Sunlight is a benefit and a detriment. On one hand, photosynthesis gave bacteria the ability to harness the plentiful and accessible resource of sunlight. This also spurred the evolution of bacterial locomotion to seek out areas of sunlight, and it is thought that the evolution of photosynthesis contributed to the evolution of cell movement towards sunlight, (Wächtershäuser, p. 126). On the other hand, the ultraviolet (UV) rays that are produced from sunlight can also harm and mutate organismal DNA. Therefore, life-sustaining organisms must have been able to balance the harmful effects of UV rays with the nutritive benefits gained from the sunlight, (Wächtershäuser, p. 126).

[1] I am thinking of *a posteriori* knowledge here, or knowledge through experience.

Water played an especially important role in regulating UV rays by filtering them out while allowing nutrients to pass through. Therefore, life was situated underwater at that time. Eventually, the accumulation of molecular oxygen (as a byproduct of photosynthesis) led to the development of the ozone layer, and this allowed organisms to move closer to the surfaces of the water without experiencing the harmful effects of UV rays (Wächtershäuser, p. 126). Wächtershäuser proposed that earth became sustainable and inhabitable for life through photosynthesis and active locomotion, and that these processes arose to find nutritive sunlight for the protobacteria to survive.

Ultimately, this theory posits that there is an evolutionary underpinning (e.g., 'rationality') for how knowledge became accessible in living organisms, and that these evolutionary and epistemic processes are closely interrelated, if not the same process. Here, the protobacteria developed sensory perception via the evolution of photosynthesis and locomotion, both of which were evolutionarily necessary for nutritive purposes. The understanding of evolutionary 'rationality' that I will use for my thesis is nicely illustrated by Wächtershäuser's theory because a story about evolutionary history is used to explain how the protobacteria formed the processes they did and how that evolved to form a type of knowledge acquisition. This broad framework of placing evolutionary mechanisms as underlying all knowledge processes is generally applied to all knowledge processes by evolutionary epistemologists.

It might be contentious to consider protobacteria as being ascribed as undergoing knowledge processes; specifically, it is uncertain whether the protobacteria know that they are acquiring knowledge themselves. For my purposes of understanding evolutionary 'rationality', what is important to emphasize is that there is significant evolutionary influence on how protobacteria gathered nutrition. Furthermore, even if we do not ascribe the protobacteria as undergoing knowledge processes, the protobacteria described are the evolutionary beginnings of all life as we

know it on earth and what we consider as knowledge processes (such as human knowledge acquisition) were fundamentally developed from these evolutionarily motivated origins.[2]

The evolution of sensory mechanisms is also central to how Lorenz characterizes evolutionary epistemology. Lorenz refers to byproduct consequences of evolutionary functions and references how machines can undergo a similar process. He writes:

> "It sometimes occurs in the evolution of organs, as also in the development of machines, that an apparatus developed to perform one particular function unexpectedly turns out to be able to perform a quite different function as well. It once happened that a calculating machine originally designed to work out compound interest surprised its inventors by showing a capacity to handle integral and differential calculus as well. Something similar is involved with constancy mechanisms of perception, which were developed under the selection pressure of the need to infallibly identify particular objects in the environment," (Lorenz, p. 117).

Here, Lorenz attributes sensory perception as having both evolutionary and epistemic significance, but places evolutionary forces as the initial drive of change. Because there was an evolutionary and selective pressure to accurately perceive the environment for nutritive purposes, it also 'unexpectedly' established accurate means to acquire and develop knowledge. The function of perception was originally established to maintain life, and a later consequence of this was accurate knowledge acquisition through perception and human thought-processing. This relationship establishes the groundwork of evolutionary epistemology, and the later sections stem and develop from this conceptual foundation.

So far, evolutionary epistemologists have not discussed the role of emotions in human rationality or emotion's evolutionary history. However, many other thinkers have explored the potential role of emotions in evolution, albeit from various standpoints that motivate their own research. The ones I draw from in the next chapter argue that emotions play a fundamental role in framing and maintaining evolutionary 'rationality' by its role in the composition and understanding of human

[2] Thank you to Ben Law and Jeff Kasser for bringing this point to my attention!

evolution, such as by having an interconnected evolutionary history, and by playing certain roles that are epistemically valuable, such as by having motivational force. I contend that the consideration of emotions would alter our current understanding of evolutionary 'rationality' and how it frames evolutionary epistemology. I further argue that incorporating emotions can further illuminate an epistemic theory that prioritizes human's role in the grand scheme of the biological sphere as evolutionary epistemologists strive to do.

1.2. Epistemic Fallibility

A consequence of adhering to an evolutionary 'rationality' is the fallibility of human knowledge. Epistemic fallibility is concerned with the capability for humans to be incorrect about what humans think they know or the inevitability of sometimes reaching false conclusions. This suggests that human knowledge acquisition is laden with falsehoods. As defended by Catherine Elgin (2017) and others, I assert that these false conclusions are not always epistemically detrimental in established ways that they are made out to be. For example, falsehoods can end up being epistemically fruitful by being necessarily directive towards the relevant knowledge. But first, I go over common conceptions about the fallibility of human knowledge from evolutionary epistemologists and then introduce why it may be helpful to talk about emotions within this scope.

One example of how epistemic fallibility is recognized and incorporated is seen in Popper's description of scientific progress and falsifiability. Popper denotes science as learning through trial and error: "The method of learning by trial and error—of learning from our mistakes—seems to be fundamentally the same whether it is practi[c]ed by lower or by higher animals, by chimpanzees or by men of science," (Popper, p. 52). Primitive matters, scientific progress, and knowledge acquisition in general, are advanced through trial-and-error; we do not actually know the outcomes of our

actions when we first undertake them, and this sort of process will inevitably lead to some false judgments. Regardless, the outcome, faulty or not, informs us of the next steps to take.

Popper argues that the succession of scientific theories is like the growth of knowledge: all follow a process of trial-and-error. Popper further encourages fallibility in knowledge development by promoting the idea of falsification in scientific theories. In *The Logic of Science* (2005), he writes:

> "These considerations suggest that not the *verifiability* but the *falsifiability* of a system is to be taken as a criterion of demarcations. In other words: I shall not require of a scientific system that it shall be capable of being singled out, once and for all, in a positive sense; but I shall require that its logical form shall be such that it can be singled out, by means of empirical tests, in a negative sense: *it must be possible for an empirical scientific system to be refuted by experience,"* (p. 18).

By focusing on falsifiability as a crucial criterion in his framework of scientific methodology, Popper highlights the importance of fallibility for knowledge production by insisting that an adequate scientific method must be able to be proved wrong rather than be proved right. Approaching this in his more negative sense emphasizes that error is a foundational feature of scientific theory development and that it is inevitable in our epistemic growth. A couple of differences between Popper's framework and how I want to develop evolutionary epistemology is that under Popper's framework, we can only know what is *not* right rather than what *is* right. That is, falsification is the only thing we can do to develop scientific theories, and there is no way to determine whether a scientific hypothesis is true or not (Popper, p. 20). His theory also only concerns scientific knowledge. Conversely, my discussion concerns knowledge in general. While they are distinct from each other, I consider the two types of knowledges as similar in its development and process.[3]

Along with scientific research, trial-and-error can also be seen in more basic acts. Take foraging for berries for example: This berry looks delicious! But it has consistently given me a stomachache the

[3] The differences between these types of knowledges do not seem to be relevant for my thesis. Importantly, because scientific knowledge comprises a lot of our general knowledge, I lump scientific knowledge and general knowledge together here.

last three times I had it, so I probably should just avoid it. In this case, I initially perceived the berry as delicious (maybe it was a ripened red and smelled sweet), but upon realizing that it was a berry that I had encountered before with adverse stomach effects, I was able to avoid the stomachache. I remembered that this specific type of berry gave me a stomachache, and I was able to use this information to make a later decision that benefitted me in the long run. This example exhibits the value of fallibility in the growth of knowledge because it suggests that the growth of knowledge is achieved through a process of *not* knowing what the consequences are or through experiencing an unfavorable outcome. Nonetheless, we aim to try our best and learn from those unknown consequences and outcomes and retain the information we find relevant and important to us for future epistemic use.

More broadly, inductive reasoning in general can be seen as *always* fallible. While consistent outcomes give us good reason to believe a causal relationship, such inductive reasoning is also fallible in the sense that its consistency does not guarantee its occurrence. This idea is considered in Hume's *An Enquiry Concerning Human Understanding,* where Hume describes how all inferences are fundamentally derived from experience and that inductive inferences assume a certain causal relation within these experiences (Hume, Section IV, p. 29). While we infer the sun will rise every morning, it is not guaranteed (hence, fallible), as the inference is only based off past causal relations that have reliably occurred previously. Therefore, inductive processes can be seen fallible on an even broader scope: it acts both on the inductive process, like in Hume's formulation, and within the inductive process, like in Popper's formulation.

The idea that human knowledge acquisition is driven by a trial-and-error process is also defended by Campbell and Lorenz, although worded differently. In *Evolutionary Epistemology* and *Blind Variation and Selective Retention in Creative Thought as in Other Knowledge Processes,* Campbell posits all induction

processes as having two distinct stages: blind variation and selective retention. Within this process, there are three essential features: there must be a mechanism for introducing variation, one for consistent selection processes, and one for preserving and propagating selected variations (Campbell, p. 57). He uses the term 'blind' instead of 'random' and writes:

> "...certain processes involving systematic sweep scanning are recognized as blind, insofar as variations are produced without prior knowledge of which ones, if any, will furnish a select worthy encounter," (Campbell, p. 57).

A 'blind' process can have a systematic method to sweep and interpret its environment, but the variations ultimately do not depend on the outcome in any way. That is, the events leading up to an outcome are not aware of what outcomes are preferable or amenable or "worthy to encounter", and it is in this way that the process of variant generation is 'blind'. However, because the process is still systematic, it is not random.

Campbell lists three motivators for using the term 'blind' rather than 'random': the first is that the mutations occur independently of the environmental conditions present at that time. Secondly, the individual variation of results is uncorrelated with the result itself, where uncorrelated means that the variations that arise are not tailored or concerned with the results. The last connotation is that the variation of results does not influence or inform the previous trial or future trials[4], (Campbell, pp. 56-7). These connotations give a more thorough sense of what Campbell is hoping to achieve by using the specific term 'blind' and how they suggest strong uncertainty towards the outcome.

This understanding of 'blind' is akin to Popper's understanding of trial-and-error because both imply that epistemic mistakes are inevitable in the growth of knowledge. Blind selection can be seen as a process of trial-and-error because a 'blind' trial that leads to an epistemically unfortunate

[4] This is acted on a certain level that Campbell lays out, but this discussion isn't necessary for the sake of my thesis.

consequence will be, nonetheless, informative on what steps to not take. Campbell extends this idea further and places selective retention as an efficient way to navigate those next steps in our epistemic processes.

Campbell and other evolutionary epistemologists regard the entire process of evolution as a process of knowledge acquisition because it can be construed as a process of blind selection and selective retention of advantageous variants (Campbell, p. 91). Lorenz emphasizes that selective retention is what differentiates an organic system from an inorganic system: it is the ability to pass genetic information to offspring that differentiates organic from inorganic systems, and this allows for the selective retention of genetic information that can incur later benefits to the offspring (Lorenz, p. 21). Within the central dogma of biology, blind variation can be seen as occurring through the different ways DNA information can be spliced and mutated. Selective retention may be seen through the retention and promotion of certain DNA sequences; individuals that are more fit will more likely pass these DNA sequences to future offspring, thus selectively retaining genetic information that is more evolutionarily beneficial to the offspring.

Understanding evolution as an epistemic process (e.g., following an evolutionary 'rationality') is a key idea that many evolutionary epistemologists ground their work in. Lorenz describes his aims for *Behind the Mirror* as consistent with Campbell's:

> "In his 'Evolutionary Epistemology' Campbell writes: 'The natural selection paradigm of such knowledge increments can be generalized to other epistemic activities, such as learning, thought and science.' I not only agree with this statement, but I regard it as one of the main tasks of my book to undertake just such a comparison of the various mechanisms by means of which different living systems acquire and store the information relevant to their needs," (Lorenz, p. 24).

In this passage, not only does Lorenz assert that natural selection is a driving factor of knowledge acquisition, he extends its scope to virtually all forms of knowledge acquisition. According to

evolutionary epistemologists, looking at it this way informs us more of the motivations and limits of human knowledge and its relation to animal knowledge.

To better understand the scope of Lorenz' claim, we can imagine how inductive processes are used to acquire non-biological information and knowledge. Take a detective on a case: they will be prompted to talk to specific people in hopes of gaining some information. These instances are a type of blind variation because the detective's process is guided by some sort of end goal (i.e., to find out what happened or who the culprit is), but the path of how to get there is unclear. It is clear enough to the detective that they must talk to specific people to get information related to the case, and so the path towards resolving the inquiry is not completely random. However, it is uncertain that they will actually get pertinent information upon talking to these people and that makes the inquiry 'blind'. Regardless of the outcome, information is gained with what the detective does, and the detective is informed of future steps to take: the detective may discover valuable information for the case, or they may be redirected to another individual that could have relevant information, or they might be at a dead end of what to do next. In any case, they acquire information that is worthy enough to retain, and that information is used to further inform them of what they might do next to achieve the next epistemic aim; this part of the process is selective retention.

In summary, there are numerous and varied types of inductive processes that incorporate a type of blind selection and a type of selective retention, and these processes necessarily incorporate the fallibility of human knowledge. According to evolutionary epistemologists, all inductive processes are acts of knowledge acquisition and all are acts fundamentally motivated by evolutionary means. Condensing all these ideas into a systematic categorization, Campbell discusses a set of levels that encompass both biological and social (cognitive) evolution in increasing complexity (Campbell, p. 57). These discrete levels broadly describe how knowledge acquisition became more efficient, or

more vicarious, over time. He maintains that each level is an inductive process itself and that each level becomes more efficient in acquiring knowledge (Campbell, p. 57). The ten levels are:

1. Non-mnemonic problem solving
2. Vicarious locomotor devices
3. Habit
4. Instinct
5. Visually supported thought
6. Mnemonically supported thought
7. Socially vicarious exploration: observational learning and imitation
8. Language
9. Cultural cumulation
10. Science

Each level is a case of knowledge acquisition, and each has an influence on how humans became more evolutionary fit. However, it is not the case that each level is necessarily better at doing these things. That is, each level solely describes a more *efficient* method towards acquiring knowledge and becoming fitter, not a method that leads to a more *accurate* acquisition of knowledge or a method that leads to better fitness than what would have been (Campbell, p. 56).

Campbell's discrete levels is a sort of cumulation of all the ideas discussed so far: evolutionary 'rationality', trial-and-error, inductive processes, and the ultimate overlap of evolutionary and epistemic processes. Each level illustrates a more efficient methodology towards our evolutionary and epistemic needs that encompasses blind variation and selective retention. Recognizing that human knowledge is fallible becomes remarkably crucial to consider within this framework as its role in inductive processes is a fundamental part of knowledge acquisition and propagation within these levels.

Under the evolutionary epistemologists' framework, fallibility is inevitable. While they do not make any clear claims whether fallibility is epistemically beneficial or not, its inevitability suggests some sort of epistemic significance or relation because they hold that it is present in all knowledge processes. My claim, to be defended in more detail in the next chapter, is that emotions are a straightforward answer to how epistemic fallibility acts on our epistemic processes. Particularly, emotions are a fitting answer for how epistemic fallibility occurs by informing knowers of their own epistemic fallibility, as well as informing knowers of others' epistemic error. It can also inform knowers of how to proceed upon making an epistemic error. While it has been traditionally construed as epistemically harmful, I contend that epistemic fallibility and emotions' role within it positively contributes to aims as construed by our evolutionary epistemologists and are, thus, favorable to study. In the next chapter, I explore arguments targeting general epistemic norms and expectations, and then suggest a normative shift that is more conducive towards emotions' role in epistemology that have been encouraged by the likes of Jane Friedman (2014) and Catherine Elgin (2017).

1.3. Epistemic Creativity

Along with fallibility, evolutionary epistemologists hold similar views on how epistemic processes require creative thought. While many of them acknowledge the value of creativity in knowledge acquisition, they also fail to seriously investigate these more creative avenues towards knowledge acquisition. Rather, there is an emphasis on following the evolutionary 'rationality' that is akin to how a machine solves a problem, with little concern towards creativity's role and its features in human knowledge acquisition. In this thesis, I highlight this discrepancy and argue that evolutionary epistemology would benefit from a more thorough investigation of epistemic creativity and 'irrationality' that, according to evolutionary epistemologists, is important in facilitating human

knowledge processes. Fittingly, I think that emotions can play a significant factor in how this creativity is established and developed. First, I will explain how creativity is understood by evolutionary epistemologists and then discuss how emotions can contribute to epistemic creativity.

Campbell introduces the relationship between inductive processes and creativity: "Today, we find the blind-variation-and-selective-retention model most plausibly applied at the levels of organic evolution and trial-and-error learning of animals, and at least palatable as a description of creative thinking," (Campbell, p. 96). Campbell quotes Paul Souriau to further establish creativity's role in inductive processes. Souriau discusses how chance must precede true innovation, and he points out that rationality and logic can guide us on how to end inquiries, but not on where to start inquiries:

> "It is said that a question well posed is half answered. If so, then true invention consists in the posing of questions. There is something mechanical, so to speak, in the art of finding solutions. The truly original mind is that which discovers problems. But here again, it does no good to speak of method, since method is the application of already existing discoveries. The discovery of a new problem can therefore only be fortuitous. Thus we see the role of logic diminish and that of chance increase as we approach closer to true invention," (Souriau, pp. 17-8).

Souriau's description of inductive processes is reminiscent of Popper and Campbell's formulation of trial-and-error and blind variation. Namely, to follow a kind of logic is to follow what one thinks is the best course of action towards the most ideal outcome. While this framework is largely successful in epistemic pursuits, it is not always the case: in both epistemic and evolutionary processes, we commonly know what sort of outcome we would like but we do not always know the best way to achieve a particular outcome. In this way, the growth of knowledge at least partially depends on discovering new problems and exploring newfound methods rather than finding solutions and following logical methods.

That is not to say that following a logic is not important; a balance of both innovation and logic is needed to best understand the growth of knowledge. Souriau asserts the importance of chance and innovation as the catalyst for the growth of knowledge, but there needs to be a balance between the

more mechanical/rational aspects of knowledge acquisition and the more fluid/creative aspects of knowledge acquisition in order to best acquire and develop knowledge. I think analogies comparing evolutionary 'rationality' to machines and robots tend to undermine the importance of chance and innovation as these analogies tend to emphasize the mechanical aspects of the process and not the creative aspects. For example, the recent developments on artificial intelligence (AI), such as chatGPT, can restructure and create essays that seem innovative and new. However, the way the AI works to create these essays is by following an algorithmic process of what is commonly typed before or after words by humans. In other words, while it seems like the essays are creative, they only can feign true creativity by fundamentally relying on an algorithmic process of previously fed data.[5] When faced with an unexpected word or a new relation between words, the AI is unable to navigate or understand these relations without referring to previous inputs because the AI can only process as much as what humans develop and program within the AI. Humans can understand unexpected relations differently by referring to what is previously known or understood by them *and* by tapping into our epistemic creativity to form an entirely new causal relation that may or may not be extrapolated from what we previously knew. While chatGPT can refer to what is previously known or programmed into it, it is unable to develop newfound relations in the same way that humans can. Ultimately, I think that the widespread use of mechanical analogies within evolutionary epistemology undercuts the importance of creativity and innovation in the growth of knowledge by underemphasizing creative aspects of epistemic processes. Mechanical analogies are unable to accommodate and account for epistemic creativity in the same ways that humans can, and, from this, it follows that it also undercuts the role of emotions in these processes.

[5] Thanks to Paul DiRado for explaining chatGPT and how it works!

Nonetheless, evolutionary epistemologists continue to explicate human cognition using cybernetics and systems theory, addressing creativity's role but failing to elaborate on its important relations to our knowledge processes. For example, Lorenz introduces the term *fulguratio*, or 'flash of lighting', to describe a flash of creation and creativity from the Gods above. He compares *fulguratio* with what a scientist experiences when they discover something new, emphasizing that both are prompted by "a short circuit, a new connection," (Lorenz, p. 30). He describes how new links that arise can change the linear causal chain into a positive or negative feedback loop and how newfound discoveries are not miracles but only an interaction between subsystems that merge to form a new causal link (Lorenz, p. 30).

I think these sorts of descriptions imply that the growth of knowledge is wholly derived from previously existing interactions and highlights the rationality and systematicity of these interactions in comparison to the more creative aspects of them. By positing causal chains and loops as the means to discovering new problems, Lorenz stresses more logical considerations while failing to appreciate the necessary creativity within these causal chains and loops that shed light on these new problems in the first place. This analogy is an example of how discoveries explicated via mechanical analogies under-motivate the study of epistemic creativity, despite acknowledging its role in the growth of knowledge. Relying on mechanical analogies is important and useful but, because the nature of how machines function, the fixation on these analogies obscure certain features that are also important and useful, such as epistemic creativity.

At the end, there ought to be a balance between rationality and creativity to successfully develop human knowledge: it can be said that a creative *fulguratio* occurs upon unique evolutionary development that is foundationally driven by evolutionary 'rationality', and that evolutionary

'rationality' can lead to a new creative *fulguratio*. Both are necessary in our knowledge processes.[6] In this section, I have established grounds for why creativity should be valued in human knowledge acquisition as understood by evolutionary epistemologists. While they repeatedly discuss and refer to creativity's role in epistemic processes, they fail to explore the intricate mechanisms of creativity and how it impacts the aims of epistemology. I contend that examining epistemic creativity is crucial in evolutionary epistemology because its study will better inform us of our epistemic aims.

Even more importantly, emotions heavily influence and motivate epistemic creativity. Therefore, it also ought to be incorporated within epistemic discussion and especially within evolutionary epistemology. Because so many analogies within evolutionary epistemology about knowledge acquisition are centered around mechanical processes that follow a logical and algorithmic process rooted in what we know, it becomes plausible that we underemphasize the innovative creativity and emotions of epistemic processes, even though evolutionary epistemologists recognize it as integral in understanding human knowledge. Like emotions' role in epistemic fallibility, they can inform and motivate knowers of innovative and creative solutions towards discovering new inquiries and during the inquiry process itself. Placing emotions as something worth considering in evolutionary epistemology will bring forth newfound ideas regarding innovative epistemic creativity that clearly inform, progress, and develop the acquisition and growth of human knowledge on a biological and evolutionary level.

[6] A suggestion that relates to this very well is Peirce's construal of abduction and how it incorporates both creative and logical features; abduction is something I see fitting in very well here and would like to incorporate it within my work here! Thank you to Jeff Kasser, Jeff Snodgrass, and Kenny David for prompting me to think about this!

1.4. Summary

So far, I have introduced evolutionary epistemology as understood by three key thinkers: Donald Campbell, Konrad Lorenz, and Karl Popper. I have identified three common features between them that illustrate and frame what evolutionary epistemology is and what its aims are. First, I discuss how evolutionary epistemologists use an underlying notion of evolutionary 'rationality'. Importantly, it prioritizes evolutionary underpinnings for all human knowledge processes. From this evolutionary 'rationality', two salient epistemic features are highlighted: epistemic fallibility and epistemic creativity. Evolutionary epistemology understands both fallibility and creativity as necessary features of all human knowledge processes. However, evolutionary epistemologists fail to explore the mechanisms of these fundamental epistemic features that are present in our epistemic activities and how they affect our knowledge acquisition and growth. In the next chapter, I develop the evolutionary epistemologists' framework with emotions in the forefront: I lay groundwork and arguments for why emotions ought to be considered within the scope of evolutionary epistemology by developing a case for emotions' evolutionary history and then exploring the various ways emotions can contribute to human rationality, epistemic fallibility, and epistemic creativity.

CHAPTER 2 – EMOTIONS' PLACE IN THE FOUNDATIONS OF EVOLUTIONARY EPISTEMOLOGY

2.0. The Evolutionary History of Emotions

In this chapter, I dive into specific arguments for why emotions can and should play a serious role in evolutionary epistemology. I start by laying out theories and empirical evidence supporting emotion's history and role in human evolution. Section 2.1-2.3. will follow the same structure as my former chapter; each will go into how emotions can enhance our understanding of knowledge acquisition and development within the three facets discussed: evolutionary 'rationality', epistemic fallibility, and epistemic creativity. My goal by the end of this chapter is to convince you that incorporating emotions within the discussion of evolutionary epistemology will only support the aims of evolutionary epistemologists by broadening our understanding about the growth of human knowledge and about the continuities and discontinuities of human knowledge with animal knowledge. First, I will start by giving an account of why we should grant emotions as having an evolutionary history and why it is important for my account. Because evolutionary epistemologists want to understand how we evolved our epistemic mechanisms and because emotions have a clear evolutionary history that coevolved with evolutionary 'rationality', it follows that emotions ought to be included within these discussions to better understand the evolution of our epistemic processes.

Evolutionary epistemologists clearly admire and utilize much of Darwin's theory in evolutionary epistemology. As discussed in the former chapter, they place Darwin's theory of evolution as constitutive in the development of the evolutionary epistemic framework. While evolutionary epistemologists fail to adequately discuss emotions, Darwin does in *The Expression of Emotions in Man*

and Animals (1872). While much of Darwin's discussion focuses on the evolution and universality of expressions, he clearly links expressions to certain emotions (as suggested by his title):

> "We are so familiar with the fact of young and old animals displaying their feelings in the same manner, that we hardly perceive how remarkable it is that a young puppy should wag its tail when pleased...[w]hen, however, we turn to less common gestures in ourselves, which we are accustomed to look at as artificial or conventional,—such as shrugging the shoulders, as a sign of impotence, or the raising the arms with open hands and extended fingers, as a sign of wonder,—we feel perhaps too much surprise at finding that they are innate," (Darwin, p. 352).

Not only does Darwin describe and link expressions as a response to innate emotions, but he also places this phenomenon across other species. He backs his claim by reiterating his observations that different species express similar sentiments to humans (such as apes) and that certain expressions are evolutionarily conducive for species survival (Darwin, p. 281). For example, Darwin proposed that being surprised was generally expressed with widened eyes, and that this increased our field of vision and visual responsiveness to environmental dangers (Darwin, p. 281).

Essentially, Darwin asserts that the expression of emotions evolved to serve two classes of function: (1) to prepare the organism in responding adaptively to environmental recurrent stimuli and (2) to communicate critical social information, (Shariff & Tracy, p. 395). In respect to emotions, function (1) is a form of adaptation using expressions of emotion as a type of physiological regulation, and function (2) is a form of exaptation regarding emotion's evolved use of communication over time. Exaptation is a biological concept defined as "the common evolutionary process whereby a feature that evolved for one reason gradually morphs to serve a secondary adaptive function" (Shariff & Tracy, p. 396). We have already encountered exaptation in Wächtershäuser's theory about the origins of sensory perception: the feature of accurate sensory perception was fundamentally evolved from the nutritional needs of protobacteria and only over time did this feature become adaptive towards what we see as knowledge acquisition and development today. Similarly, emotional expression

evolved to help organisms respond to their environments and then became a crucial part of how we acquire, communicate, and use evolutionary and social knowledge.

Function (1) can be illustrated if we imagine ourselves in a potentially dangerous situation: the presence of a snake in the grass elicits an emotional response of fear, and that fear promotes actions that are conducive to our survival. For example, widened eyes promote our visual responsiveness and field of vision, which allows us to respond more effectively towards the snake's actions. While function (1) is a clear and commonly used example of how emotions can impart evolutionarily relevant knowledge, I want to focus more on function (2) because I think it paints another picture of emotion's evolutionary history in a novel way.

Function (2) is framed using a two-stage model of emotion-expression evolution proposed by Shariff & Tracy in *What are Emotion Expressions For?*. They refer to a general theory of biological signaling argued by Oren Hasson, where he proposes that many biological signals evolved from a cue. Cue and signal are differentiated as such by Hasson:

> "Signals evolve by signal selection because they change recipients' information state, despite their negative effect on [the signalers' basal fitness component]. Cues, in contrast, such as prey age or size, may be non-heritable or evolve by natural selection alone. They confer no costs on [the signalers' basal fitness component] and are sometimes maintained despite the fact that they change recipients' information state," (Hasson, p. 140).

In other words, a cue is something that relays information that can be outside of adaptive reasons or is a communicative byproduct of other adaptations that are evolutionary significant. For instance, seeing someone chew generally means the person is eating something, but chewing did not evolve to communicate the idea that they are eating something; the evolutionarily significant action of chewing is for the purposes of breaking down the food, (Shariff & Tracy, p. 396). In contrast, a signal is an evolutionarily significant form of communication, such as the male peacock's bright display of feathers as a sign of viability and ability to reproduce (Shariff & Tracy, p. 396).

Shariff & Tracy posit that the formation of emotions in humans started as a cue and evolved to become a signal. That is, emotions originally gave us information about our internal states regardless of whether they informed us of evolutionarily beneficial information or not. Over time, as communication became more important for survival, it also became more important for emotions and the associated expressions that arise from them to convey increasingly important (e.g., evolutionary) information (Shariff & Tracy, p. 396). Imagine the role and importance of communication between protobacteria in Wächtershäuser's theory compared to the role and importance of communication between modern humans: protobacteria do not need to communicate with other protobacteria to survive while modern humans do need to communicate, quite often, with each other to survive.

Together, these theories from Hassan, Shariff & Tracy establish a more comprehensive conception of how emotions came to play a more evolutionarily important role over time. They do this by emphasizing the importance of communication in modern humans for evolutionary purposes and anticipating social information. While I distinguish evolutionary purposes and social purposes, they often occur with each other, as social matters, especially in humans, heavily overlap with our evolutionary purposes. For my purposes, I discuss them as more separate features despite this overlap to better elucidate my arguments.

Emotions are a clear way of communicating social information, such as their use in recognizing and adopting cultural etiquette. They are also commonly used to empathize with others and to navigate social settings. With human technological advancement, the speed and efficiency of communication between humans has amplified and made knowledge acquisition more collectively involved in more complex ways; for example, the invention of the internet exacerbated the spread of information, both true and false. These sorts of changes further support the influence of emotions on our

epistemic matters, both in evolutionary and social circumstances, because they are involved with how we navigate and attend to incoming information.

Another theory that defends emotion as a crucial evolutionary component can be seen in the moral domain. In *Touching a Nerve: The Self as Brain,* Patricia Churchland argues that social and evolutionary mechanisms, such as emotions of care, necessarily affect our moral values:

> "Here is where we are in the values story: that anything that has value *at all* and is motivating *at all* ultimately depends on the very ancient neural organization serving survival and well-being. With the evolution of mammals, the rudimentary self-caring organization was modified to extend the basic values of being alive and well to selected others—to *me* and *mine*," (Churchland, p. 98).

While her discussion concerns moral values, it is similarly rooted in the idea that emotions, such as feelings of care, have evolutionary underpinnings, such as supporting the survival and well-being of yourself and your loved ones. She also discusses biological mechanisms that encourage emotions of care, such as the intense release of oxytocin in birthing mothers that facilitate immense care and love towards their newborn, (Churchland, p. 94). What is worth highlighting here is that there is empirical data on the causal relation between a peptide released in the brain and the associated emotions that prompt actions of care and protection. Since there is the existence of such chemicals and reactions in our brain, and since its mechanisms have remained relatively consistent in the evolutionary development of humans[7], it suggests that this process imparts some evolutionary advantages in some way.

For evolutionary epistemology's purposes, emotions play a role in signaling information by imparting some type of knowledge. Namely, they aid in imparting certain knowledge that is conducive to our evolutionary fitness, and these types of arguments are what I will discuss in the next section. In this section, I have laid out arguments for why we should recognize emotion's

[7] Here, I am thinking of how many different species over the course of life must have also cared for their offspring in similar ways.

evolutionary history from an evolutionary and social perspective. Given that emotions' evolutionary history influences our processes of rational thinking and its evolutionary history, it becomes clearer why emotions can be influential to the construction of evolutionary 'rationality'. In my next section, I assert that emotions can be influential through their ability to be informative towards knowledge conducive to our evolutionary fitness, and, thus, be important in understanding evolutionary 'rationality'. After that, I will fill in the connection between my newly considered evolutionary 'rationality' and more specific roles that evolved emotions can play in promoting the aims of evolutionary epistemology.

2.1. Emotion's Role in Evolutionary 'Rationality'

For the rest of the chapter, I defend the role of emotions in more specific evolutionary epistemic aims. My previous section defended emotions' evolutionary history and its connection with various kinds of evolutionary, social, and moral knowledge. I now organize the following sections in a way that paints a more cohesive picture of how emotions fit into Campbell, Lorenz, and Popper's summary of evolutionary epistemology. I begin by reiterating what evolutionary 'rationality' is. Next, I explain a framework for how we can understand the more specific roles emotions play in general epistemology derived from Georg Brun & Dominique Kuenzle's introduction in *Epistemology and Emotions*. Lastly, I discuss studies and theories that concern how emotions are important and informative towards certain types of knowledge conducive to our evolutionary fitness while also promoting our aims of evolutionary epistemology in tandem. These all build to support my broader claim that emotions must be included within the scope of evolutionary 'rationality'.

I construed evolutionary 'rationality' as the implications and consequences of following a Darwinian theory of evolution. Evolutionary 'rationality' is centrally guided by reasoning due to the inevitable environmental constraints that prevent us from knowing all relevant and useful information in each

situation. Importantly, evolutionary epistemologists hold that all knowledge processes have evolutionary underpinnings. In other words, knowledge processes are fundamentally motivated by evolutionary means; in this way it is evolutionarily relevant and can relay knowledge that is ultimately conducive to our evolutionary fitness.

An objection could be raised here about whether it is the case that all knowledge is evolutionarily significant. For example, my ability to know that the sky is blue does not seem evolutionarily significant. To clarify, I agree that it is not the case that every instance of knowledge will be evolutionarily significant (although it is evolutionarily significant to see color in some instances for our survival, such as seeing a traffic light or avoiding a poison dart frog). However, evolutionary epistemologists hold that all *epistemic mechanisms* are evolutionarily driven. That is, the ways in which we acquire knowledge (e.g., sensory perception) are fundamentally formed by evolution, and it is in this way that knowledge processes are seen as evolutionarily significant.

I argue that emotions promote a clear avenue for acquiring knowledge that is conducive to our evolutionary fitness. To have an evolutionary history signifies a recognition that the thing of interest was or is prone to evolve in some way; in this case, I've argued so far that emotions have plausibly evolved in some manner that promoted our evolutionary fitness. In this section, I paint an even stronger relationship between emotions and evolution by laying out why emotions can provide us with knowledge that is conducive to our evolutionary fitness on an individual and collective level.

First, I introduce previously discussed roles emotions can play within epistemology. In the introduction of *Epistemology and Emotions,* Brun & Kuenzle explicate five roles:

> "[W]e look at the most frequently mentioned candidates for epistemologically relevant features and functions of emotions. These are motivational force, salience and relevance, epistemic access to facts and beliefs, non-propositional contributions to knowledge and understanding, and epistemic efficiency," (Brun & Kuenzle, p. 19).

Out of the five features, I focus on three in my defense: motivational force, salience and relevance, and epistemic efficiency. While they all pertain to my defense in one way or another, these three are the most relevant and defend my point best. I will briefly summarize the three roles of interest and motivate why I refrain from discussing the other two ones as thoroughly.

First, emotions can motivate cognitive acts by directing our attention towards a wide array of things, reframing existing ideas and promoting critical reflection (Brun & Kuenzle, p. 16). It is widely accepted that emotions are motivational, but it is less clear whether emotions are epistemically motivational and relevant.

Secondly, Brun & Kuenzle summarize salience and relevance using de Sousa's thesis about emotions being "determinate patterns of salience among objects of attention, lines of inquiry, and inferential strategies," (de Sousa, p. 137). Catherine Elgin defends that it can also be "a frame of mind or pattern of attention that synchronizes feelings, attitudes, actions, and circumstances," (Elgin, p. 148). Rather than addressing our attention towards a singular concept or circumstance, emotions can also implicitly influence other actions and decisions in nuanced and complex manners.

Lastly, epistemic efficiency can be construed as a weak claim and a strong claim. The weaker claim holds "that emotions make it easier to perform things that could also be done in their absence," (Brun & Kuenzle, p. 27), and the stronger claim holds that "there are important cognitive functions which human cannot perform successfully at all without relying on the efficiency-enhancing quality of emotions," (Brun & Kuenzle, p. 27). An example of this can be seen in de Sousa's view of emotions and rational deliberation, where emotions make it possible to deliberate by selecting (making salient) certain information (Brun & Kuenzle, p. 21).

I think these three roles map on clearly and well to my defense. While the other two roles also map on well, they are not as relevant. For example, the strong case of epistemic access to facts and beliefs

places emotions as another source of knowledge alongside reason, perception, intuition, and so forth (Brun & Kuenzle, p.22). This formulation is unnecessarily strong for my thesis; I don't need emotions to be another independent source of knowledge conducive to our survival, I just need emotions to have a clear role in imparting knowledge that is conducive to our survival. I also do not discuss non-propositional knowledge, as I am centrally concerned with propositional knowledge.[8]

As appropriate, I will reference the roles as a way of framing my arguments in a more precise manner. While Brun & Kuenzle do not explicitly tie these aims to evolutionary underpinnings (since they focus on general epistemology), I argue that we can understand these roles as having (at least) an end goal of being informative towards knowledge conducive to our evolutionary fitness.

On an individual level, emotions can convey knowledge that is evolutionarily remarkable. What I mean by an individual level is that the knowledge being relayed is relevant and significant to only the individual. Neuroscientist Joseph Ledoux has done extensive work in defending emotions as evolutionarily significant. He describes the motivation for his framework as such:

> "What follows is *not* an attempt at explaining or defining emotion. Instead, the aim is to offer a framework for thinking about some key phenomena associated with emotion (phenomena related to survival functions) in a way that is not confounded by confusion over what emotion means," (LeDoux, p. 654).

While it is difficult to define what emotions are and how they relate to epistemic matters, LeDoux emphasizes that there are certain relationships that seem clear enough to consider, such as emotions' relationship to survival-related phenomena. A common example here is how fear signifies danger to one's survivability. LeDoux writes, "defense against harm is a fundamental requirement of life. As

[8] I think these roles can be incorporated within my defense, as I am sympathetic to them imparting evolutionarily significant knowledge. Despite its fittingness, it is something outside of the scope of my main defense; I discuss these roles more in Chapter 3 when I talk about the implications of accepting my defense.

noted above, even single-cell organisms can detect and respond to harmful environmental stimuli," (LeDoux, p. 656).

To understand the fear response in humans and how it relates to our epistemic matters, we must first look at two distinguishable neural circuitries that invoke it. In humans, fear invokes two major parts of the brain: the thalamus and amygdala, and sensory information can be invoked via two different circuits. The first one is that sensory information can travel straight from the thalamus to the amygdala, and this elicits quick, almost reflexive, autonomic and motor responses. The other is that sensory information is relayed from the thalamus to other cortical sensory areas, such as somatosensory cortex for touch. This communication between the thalamus and other areas can inform the amygdala's response and reduce the fear response from the amygdala upon appraisal (LeDoux, p. 657).

While the latter circuitry is more informed and reasoned, it is also a slower process. Dangerous situations that require a quicker response, such as an unexpected snake in the grass near where you stepped, are time-sensitive and go through the first type of circuitry that I described. While this could cause me to be frightened and have an erroneous response, such as jumping away from a stick rather than a snake, the erroneous response is evolutionarily beneficial because the consequences are too risky: you may die if the snake is venomous, for example. On the other hand, if I was in a less time-sensitive situation, such as unexpectedly seeing a shark in the corner of my eye but at an aquarium, then my initial reaction of being frightened is soon mitigated by other information that makes me realize that I can't be harmed by the shark. This primarily goes through the second type of circuitry.

An objection may be that these specific responses are not epistemically useful or knowledge conducive. This is because my response of fear, especially when it goes through the first circuitry I

described, led to a wrong perception of the stick being a snake or the shark being close enough to harm me. I emphasize that the emotions were knowledge conducive in the sense that they prioritized my attention and ideas towards evolutionarily significant properties and facilitated knowledge processes that led to evolutionarily significant information. In this case, whether the object was a stick or a snake, the reflexive and erroneous response led to an evolutionarily beneficial outcome. Specifically, my actions prompted newfound information, such as allowing me to take an easy breath after realizing I was not in danger or quickly responding to protect myself from the danger. These certain perceptions and its fallibility still led to the eventual understanding that these situations weren't dangerous, and even if the information is erroneous, it was still evolutionarily useful and significant to the growth of my knowledge. The benefits of epistemic fallibility, or being wrong, are discussed more thoroughly in the next section when we consider the different ways epistemic norms can be formed. In the meantime, evolutionary epistemologists find fallibility an inevitable outcome in human knowledge processes, so it is not like we can find a way to avoid fallibility under their framework.

We have gone over how emotions can be evolutionary informative on an individual level. Emotions can also play a role in relaying evolutionarily informative knowledge between others or collectively. Being the social species that humans are, communication has been increasingly prominent in our day-to-day living and survival mechanisms. As Darwin notes, emotions and expressions are closely interlinked, where a certain expression tends to be associated with a certain emotion. These associations have been found to be universal, regardless of whether there has been exposure to literacy and western culture. In *Constants Across Cultures in the Face and Emotion* (1971), Psychologists Paul Ekman and Wallace Friesen published results further supporting Darwin's theory. They did studies on an isolated group in New Guinea and concluded:

"The results for both adults and children clearly support our hypothesis that particular facial behaviors are universally associated with particular emotions. With but one exception, the faces judged in literate cultures as showing particular emotions were comparably judged by people from a preliterate culture who had minimal opportunity to have learned to recognize uniquely Western facial expressions," (Ekman & Friesen, p. 128).

Their conclusion suggests that most emotional responses are universal; the one exception they discuss here is distinguishing surprise from fear. The other emotions tested (happiness, sadness, anger, and disgust) were all significantly associated with certain facial expressions. From these results, expressions are suggested to convey universal signals.[9] These results support the idea that while there are some culturally sensitive nuances to how expressions of emotions are shown, the expression of common basic emotions is reliable enough that the recognition of an expression imparts the same knowledge to every human; in other words, emotions impart the same knowledge because we share a common evolutionary history. For example, if I witnessed my friend eat something bad and I see their expression turn to disgust, I can reasonably infer that I wouldn't want to eat what my friend just had before they have the chance to tell me, because I can tell from my friend's facial expression alone that the food did not taste good.

An objection is that it may not be intuitively clear on how this example is evolutionarily relevant unless the food was imminently life-threatening. Or, more broadly, what it means to be evolutionarily relevant may be unclear. My understanding is that *any* action an organism takes could be thought to be evolutionarily significant because it impacts the organisms' living conditions to some capacity. Within this, evolutionarily beneficial acts are ones that promote the organisms' survivability, fitness, and reproduction rate.

To be evolutionarily beneficial doesn't only mean actions that protect us from danger alone, it can also be actions that maintain and promote our well-being within a group dynamic. For example,

[9] There have some recent developments that push back on this conclusion. Particularly, Lisa Barrett and Maria Gendron have suggested a constructivist view on universal expressions and emotions.

being socially graceful and embedded could be interpreted as an evolutionary advantage for the individual, especially given that humans are so socially immersed with each other. In psychological anthropology, among other disciplines, there have been observed causal relations between social stress (such as feeling like one doesn't fit in with their lived culture) and heightened physiological responses that cause adverse health effects. A set of genes broadly categorized as the conserved transcriptional response to adversity (CTRA) has recently been found to be sensitive towards various environmental stressors that exacerbate detrimental health effects (Cole, pp. 31-2). The mechanism here is that when more stressors are present, it potentially alters RNA expression of certain genes, specifically ones that upregulate CTRA genes. Upregulation of CTRA genes causes a general upregulation of inflammatory responses and a general downregulation of our acquired immune system response, (Cole, p. 36). In other words, something as seemingly evolutionarily irrelevant as a social disruption could lead to physically salient consequences of newly configured RNA expressions that upregulate evolutionarily harmful factors and downregulate evolutionarily helpful factors.

While emotions are evolutionarily significant in many other ways, it might be more intuitive to imagine how emotions of happiness, surprise, anger, and so forth can relay socially relevant information. Through this, we can more easily imagine how social interactions can be traditionally evolutionarily significant by being associated with biological gene expression that provoke certain health outcomes. However, I do not mean to say that all acts of well-being are evolutionarily beneficial, I just highlight a more uncommon and unexpected relationship between our social well-being and evolutionary significance: because gene expression is commonly thought of as a salient evolutionary feature, tying in social consequences and the emotions associated with it better illustrates how they can affect each other. I am not defending that all evolutionarily relevant acts are beneficial ones, because there are evolutionarily beneficial acts that may not promote one's sense of

well-being; opting out of having children could be seen as an evolutionarily detrimental act but is something that many individuals choose for their sense of well-being. Fundamentally, there can be many ways an evolutionary advantage can be defined. Since evolutionary epistemologists hold that knowledge processes have evolutionary underpinnings, I contend that emotions must play into this picture somehow because of its crucial role in relaying knowledge conducive to our evolutionary fitness and survival, in ways that are expected and in ways that are unexpected.

Building on Brun & Kuenzle's work, I've placed emotion's role in this section as salience and relevance. In the cases presented, the role of salience as described by de Sousa is demonstrated more in the individual sense: the emotion of fear undoubtedly prompted my attention wholeheartedly towards the shark or the stick/snake and what to do about it. In these instances, quick reflexive movement might be lifesaving, or, if I was mistaken, I was able to reason that following my initial response and relax. The role of salience can also be recognized in social situations, insofar as they require us to hone down on specific issues and content to interact with, and these can be evolutionarily advantageous or disadvantageous to an individual or to a group.

Social knowledge can also be informed and imparted via emotions, and, while it can work in tandem with evolutionary purposes, it also imparts knowledge that is specific to social endeavors and only progresses certain social knowledge that is more akin to Elgin's construal of salience. For example, works by the likes of Audre Lorde (1981) and Myisha Cherry (2021) discuss emotions' role as a socially functional and relevant tool. In this way emotions can aid in imparting knowledge that is conductive to our evolutionary purposes on a collective level. Particularly, they place anger as a tool for informing others about certain injustices. In *The Uses of Anger,* Lorde writes:

> "Every woman has a well-stocked arsenal of anger potentially useful against those oppressions, personal and institutional, which brought that anger into being. Focused with precision it can become a powerful source of energy serving progress and change," (Lorde, p. 8).

Oppression tends to stir a family of emotions that range from fear to anger to sadness. Lorde focuses on anger as not only a tool for recognizing an act of oppression towards oneself and towards others (being salient in a more pointed and singular manner) but also informing us of a broader way of acting and responding. Consequently, this can motivate and inspire others to act in a similar way to mitigate the oppressive act(s). She also explains how anger is notably different than hatred: "[H]atred and our anger are very different. Hatred is the fury of those who do not share our goals, and its object is death and destruction. Anger is the grief of distortions between peers, and its object is change," (Lorde, p. 8). Anger facilitates new ways of thinking and change that, in Lorde's view, promotes a more just society by generating newfound social knowledge that can facilitate this change. This is an example of how emotion's role can be applied towards obtaining social knowledge.

In summary, I've argued that emotions can play a role in redefining evolutionary 'rationality' because it necessarily influences the reasoning that stems from such a rationality. That is, emotions influence the retrieval and processing of knowledge conducive to our evolutionary fitness. To defend this, I introduced roles that were previously discussed by Brun & Kuenzle and used it to frame my arguments. In this section, I've framed emotions as primarily playing a role in epistemic salience and relevance and in the acquisition of social knowledge. I've introduced theories and studies promoting this on an individual level (e.g., conveying knowledge only to me, evolutionarily driven knowledge), as well as affecting others on a collective level (e.g., communicating knowledge to others, social knowledge). To conclude, including emotions in the scope of how we understand evolutionary 'rationality' will establish a more thorough and comprehensive foundation for evolutionary epistemologists to both better understand the growth of human knowledge and understand its continuity and discontinuity with animal knowledge. Next, I will describe how emotions can play a role in developing epistemic fallibility and epistemic creativity.

2.2. Emotion's Role in Epistemic Fallibility

Evolutionary epistemologists understand epistemic fallibility as an inevitable and inseparable feature of human knowledge processes. Popper's process of trial-and-error and Campbell's formula of inductive processes (e.g., blind variation and selective retention) necessarily entail fallibility, and they extend this to all knowledge processes. In other words, evolutionary epistemologists understand all knowledge processes as holding the potential for epistemic error. For my defense of emotions here, I take two approaches. The first approach takes arguments that often see emotions as non-truth directed (e.g., epistemically detrimental) as actually being an intuitive and useful avenue towards recognizing and understanding human epistemic fallibility. If fallibility and the associated emotions are as unavoidable as the evolutionary epistemologists suggest, then we ought not to push them aside when considering our epistemic matters. Rather, they should be incorporated so that we can better understand how to navigate our epistemic error. I further argue that, despite the prevailing historical idea that emotions obscure knowledge acquisition, emotions can promote knowledge acquisition via its fallibility. Traditionally, epistemic norms have centered on justification of beliefs and their relationship to the truth. When we consider other epistemic norms that have been underprivileged, there becomes more space for understanding how emotions can positively contribute to epistemic aims. Fundamentally, I develop this line of reasoning to argue that emotions do play an important role in this feature of evolutionary epistemology. Another way you could understand these arguments is that my first argument focuses on the causal relation of emotions towards our epistemic matters and the second argument defends a normative stance of emotions towards our epistemic matters.[10]

[10] Big thanks to Jeff Kasser for bringing this distinction to my attention!

First, emotions are already commonly seen as non-truth directed in a way that can obscure knowledge acquisition:

> "[E]motions have been charged with distorting perception, as well as leading to wishful thinking and self-deception. Explanations of such phenomena often rely on tying emotions to the will or to desires. Emotions are then criticized for being a means by which will or desire can 'take over' reason or perception, or disrupt a rational process," (Brun & Kuenzle, p. 17).

This understanding automatically bifurcates emotions from our rationality. Some striking examples of these sentiments come from Ancient Greek philosophers: for example, Plato criticizes emotions in the *Crito* and claims that Crito's emotions are obscuring him from realizing what Socrates must do:

> "Dear Crito, your zeal is invaluable, if a right one; but if wrong, the greater the zeal the greater the evil; and therefore we ought to consider whether these things shall be done or not. For I am and always have been one of those natures who must be guided by reason, whatever the reason may be which upon reflection appears to me to be the best," (Plato, p. 346).

Here, Socrates is suspicious about Crito's zeal as potentially leading him to a greater evil. He contrasts Crito's zeal with reason. According to Socrates and Plato, being guided by reason over zeal is optimal. We can see other notable Greek figures expressing the similar beliefs: Democritus writes, "medicine cures disease of the body, wisdom frees the soul from emotions," and the stoics generally held that emotions were misguided judgments, (Brun & Kuenzle, pp. 13-4). While the stoics were vehemently against emotions compared to other schools of thought, other Ancient Greek thinkers thought that there needed to be a balance between emotions and rationality and that humans tended to err more on the side of emotions.[11] Nonetheless, they establish a bifurcation between rationality and emotions that remains prevalent today.

Another striking reinforcement of this bifurcation can be seen in René Descartes' *Meditations* when he discusses his idea of a clear and distinct perception. In his fourth meditation, he explains how

[11] Big thanks to Paul DiRado for helping me better understand how Ancient Greek philosophers understood this relationship!

error and falsity occur when one fails to restrain one's will appropriately. Specifically, he constrains the will to only deal with matters of the understanding. Here, we can understand the will as more like desire or emotions and the understanding as more like rationality and logic:

> "And certainly there can be no other source than that which I have explained; for as often as I so restrain my will within the limits of my knowledge that it forms no judgment except on matters which are clearly and distinctly represented to it by the understanding, I can never be deceived," (Descartes, p. 22).

Error only occurs when one extends their will past what can be clearly and distinctly perceived.[12] What is important is that a clear and distinct perception primarily deals with matters of the intellect and rationality, and he places the will as something to regulate in relation to the understanding. Another example of the bifurcation of rationality and emotions is shown here through Descartes' description of how the will interacts with the intellect.

While these historical arguments take emotions to be obscuring information, and while it is sometimes the case that it *does* obscure information, it is the case that emotions necessarily play some role in these knowledge processes. Regardless of its impacts, there is a dynamic and causal relation between emotions and reason; an individual that experiences an injustice might feel a sense of indignation and anger, and, as a response, tend to prompt attention and action towards the injustice. Since evolutionary epistemologists hold that fallibility is inevitable, it makes sense to, at least partially, causally attribute that fallibility to emotions. It also seems especially fitting for evolutionary epistemologists to incorporate emotions in their discussion because emotions are biologically innate and have an evolutionary history.

Where my argument differs from the previous ones is rooted in the idea that emotions can contribute to epistemic aims in a positive light and not a negative one, and so its study within

[12] Understanding what Descartes means by "clearly and distinctly" is not crucial to my argument, and so I won't be delving into this.

epistemology is even more worthwhile than originally developed. Specifically, emotions are informative towards *how* inquiry ought to begin and develop. Brun & Kuenzle nicely summarize the starting point for this idea:

> "It has been argued that precisely emotions' disruptive character, so often treated as evidence for their supposed irrationality, makes them important, perhaps even indispensable, for cognition. Emotions kick in when we are cognitively challenged, when our knowledge seems false, inadequate, irrelevant or not useful," (Brun & Kuenzle, p. 19).

Here, they place emotions as important towards understanding when we err and how to proceed. However, as currently construed, epistemology primarily deal with beliefs and justification of such beliefs and its relation to the truth. I derive this distinction from Jane Friedman: "[o]ur traditional epistemic norms are, by and large, norms for belief," (Friedman, p. 4). Catherine Elgin also discusses the adherence to epistemic norms of truth: "Epistemology valorizes truth. Sometimes practical, or prudential, or political reasons convince us to accept a known falsehood, but most epistemologists deny that we can have cognitively good reasons to do so," (Elgin, p. 113).[13]

Considered together, the general scope of our current epistemic norms focuses on belief and truth-adherence, and fails to encompass parts of knowledge processes that we can imagine emotions playing a more salient role in. When we expand the scope of epistemic aims to encompass more than just conventional aims of belief and truth justification, a different picture can be painted that is more amenable to emotions. For example, Jane Friedman distinguishes these traditional norms with her proposed zetetic norms, where zetetic norms expand epistemic focus towards the entire process of inquiry rather than just the belief and justification of it (Friedman, pp. 4-5). Friedman emphasizes a zetetic turn in epistemology, where the scope of epistemic matters not only incorporates traditional norms but also incorporates "norms for the whole of inquiry, from start to finish," (Friedman, p. 5).

[13] It is also the case that both Friedman and Elgin accept truth as a norm of belief. Thanks to Jeff Kasser for bringing this up to me!

Questions that would be epistemically relevant through zetetic epistemic norms, but not traditional epistemic norms, are ones like "how did I begin the inquiry in the first place?" or "what motivated me to pursue a line of inquiry?". These questions concern aspects prior to the justification of a belief, and emotions seem to be a clear answer to these questions on both a causal and normative front. For example, if I am angry towards an injustice, I am generally prompted to resolve the injustice with my feelings of anger in mind, and it is further argued that I *ought* to act against these injustices in light of my anger. This formulation resolves both what motivated me to pursue my line of inquiry, how I began the inquiry, and what one ought to do in similar circumstances. Ultimately, zetetic epistemic norms investigate matters that deal with emotions more clearly and its acceptance supports the incorporation of emotions within (evolutionary) epistemology.

Emotions can contribute to a better understanding of the process of inquiry. Emotions like surprise, interest, doubt, and puzzlement can be seen as having epistemic significance: such emotions affect how inquiry is formed and developed. Because epistemic norms have centered justification as its primary concern, there has been less focus on these zetetic considerations that Friedman advocates for and, thus, less focus on the more normative factors relating to the process that are influenced by emotions. I attribute this role as motivational force:

> "There is an abundance of anecdotal evidence of researchers describing themselves as motivated by emotions when they tell their stories outside the academic journals (cf. The case-study in Thagard 2002). Examples of motivating emotions include surprise, interest, doubt, and puzzlement sparking inquiry, pride in standards of research, frustration and disappointment with the results achieved" (Brun & Kuenzle, p. 21).

The examples described all deal with the process of inquiry rather than the final epistemic outcome itself. Rather, the examples exhibit motivation for new inquiries and recognition of when our inquiries have gone wrong (e.g., a normative role). Studying emotions will also support the understanding of our traditional epistemic norms because the process of getting to a belief seems wholly relevant to justifying the belief: I contend that a more thorough examination of inquiry

processes that lead to a certain belief would be informative on how the belief can be justified and whether it is tracking the truth.

Catherine Elgin makes a case for the epistemic value of fallibility and encourages a reframing of fallibility in the epistemic domain in her book *True Enough*. She qualifies that thoughtful and educated mistakes may be an epistemic strength, and I argue that an effective method for making thoughtful and educated mistakes includes emotions' role:

> "The human propensity for error is typically regarded as a regrettable weakness. Certainly the propensity to make careless mistakes is a weakness. So is the propensity to jump rashly to erroneous conclusions. But, I have suggested, the propensity to make thoughtful, educated mistakes may be a strength," (Elgin, p. 305).

As described, emotions can make clear what one should do next in the face of uncertainty and error. Being angry or sad about certain things places attention and emphasis on the thing of interest, giving the emoter a sense of what one ought to do considering these emotions. Furthermore, not only can fallibility inform us of how to proceed, but it can also signify a certain epistemic status:

> "It follows that to be in a position to make a mistake marks a significant epistemic achievement. Only someone who has some understanding of a topic has the resources to have mistaken beliefs about it. Only someone who understands a good deal about it has the resources to make a significant mistake...[b]eing in a position to have erroneous beliefs about a topic requires a significant measure of understanding that topic," (Elgin, p. 301).

Elgin attributes the process of fallibility as being epistemically valuable because it takes a certain level of knowledge to be able to make an epistemic error at all. Again, we can see how traditional epistemic norms fail to encompass considerations concerning the process of fallibility (or inquiry in general) because these norms only prioritize the end results of the inquiry and whether the beliefs mapped onto the truth of the matter. Consequently, there is little discussion of emotions, as emotions' role only becomes more obvious and pressing when we consider the full scope of the inquiry process from start to finish.

The importance of values and emotions in knowledge output is also defended by Kristen Intemann within scientific research. Two theories for contextual value in scientific knowledge acquisition are introduced and defended by Intemann in *Feminism, Underdetermination, and Values in Science:* the first theory posits that some knowledge necessarily entails ethical or political content that places contextual values and, thus, emotions[14], within the scope of epistemology, while the second theory places contextual values as inextricably linked to the aims of scientific knowledge output (Intemann, p. 1010). Adopting either of these theories, we can see how scientific inference is necessarily and importantly fallible due to this relationship. When we understand epistemic norms and fallibility in the way that has been developed by Elgin and Intemann, I find emotions a compelling avenue of research towards better understanding fallibility and its inevitable consequences on evolutionary epistemology.

To summarize, I've laid out my argument for why emotions are important in understanding epistemic fallibility and our epistemic aims. I've attempted to do this using two approaches: I first argued that emotions are already seen as causally influencing epistemic access through conventional arguments that dichotomize reason and emotion. I further defended that emotions contribute to our epistemic aims by playing a normative role in knowledge processes. When we become more sympathetic to the zetetic turn that Friedman proposes in epistemology, the scope of epistemology broadens to incorporate aspects that were not originally considered, such as the whole process of inquiry. Emotions become more intuitively connected when we think of how they affect the process of inquiry rather than just the outcome of knowledge processes. Fallibility also becomes more important when we are mindful of the contextual values that necessarily interact with our knowledge

[14] When I say contextual values, I mean the sort of values that are contingent on human phenomenal experience. Emotions inextricably make up a large component of our phenomenal experience, and so I place them in relation to each other here.

output. Ultimately, understanding knowledge acquisition and development in these ways can better inform evolutionary epistemologists on how human knowledge grows and how it is continuous or discontinuous with animal knowledge.

2.3. Emotion's Role in Epistemic Creativity

Lastly, evolutionary epistemologists place creativity as another inseparable and crucial aspect of human knowledge processes. However, like how they treat epistemic fallibility, they fail to investigate the value of epistemic creativity despite understanding its significance. In the following section, I lay out my argument for why emotions can contribute to epistemic creativity in a coherent fashion that contributes to our aims of evolutionary epistemology. I start by briefly describing empirical data that ties emotions to the general creative process and then discuss how these influence epistemic matters.

I place emotions as playing two roles here: the first role is that emotionally charged creativity helps with innovative problem-seeking and prompts us on which inquiry to pursue. The second role is that emotions can help us navigate epistemic error, which, as previously mentioned, is an inevitable feature in human knowledge processes. Like emotions' role in epistemic fallibility, the epistemic norms need to be expanded to see how emotions can contribute to our epistemic processes. When we consider the entire inquiry process, emotions within epistemic creativity play a key feature in what we attend to and how we attend to it. Another way we can think of my roles construed is that if we were to imagine the process of inquiry as a linear timeline, the first role primarily concerns the point at which one begins questioning something and the second role primarily concerns the point at which one faces epistemic error during the inquiry process. In other words, they deal with the process of inquiry rather than the outcome belief itself.

The relationship between creativity and emotions might be intuitively argued when we consider how emotions play into conventional creative activities that humans do. From knitting to dancing to music to writing, a great deal of emotions goes into how we enact creativity and how it ultimately influences the final product of the creative act. For instance, it seems like a musician cannot write a song without considering, or at least feigning, emotions in the music composition and/or the lyrics. These emotions influence both the creator and the creation by concurrently affecting the creative process and the product. Creative endeavors encourage exploration of ideas and concepts that can lead to newfound and productive matters.

In *Emotions, Metaphor, and the Creative Process,* Todd Lubart & Isaac Getz tie emotions and creativity together by referring to empirical studies concerning creativity:

> "Emotion can contribute to creativity in several ways (Russ, 1993, 1995). For example, the affective pleasure in challenge may be related to curiosity and problem-finding ability; openness to emotional states may be linked to transformation ability; and positive or negative mood states may accompany creative work (Feist, 1994; Higgins, Quails, & Couger 1992; Isen, 1987; Russ, 1993; Shaw & Runco, 1994)" (Getz & Lubart, p. 285).

Getz & Lubart also link emotions as a foundational basis for "creative associations between memory elements," (Getz & Lubart, p. 285). This claim is intuitive if we think of how closely intertwined our memories are with the associated emotions of our memories. With this connection between emotions and creativity in mind, creative processes are noted but undervalued in evolutionary epistemology. I think this is because of many reasons, one of them being the lack of analogies comparing knowledge processes to more creative acts. Throughout my thesis, there have been repeated references from evolutionary epistemologists about how analogous the human knowledge process is to mechanical processes, such as how Lorenz and Campbell compare knowledge processes to circuitry and problem-solving computers. Mechanical analogies do an exemplary job of highlighting the reasoned and logical process of problem-solving, but I believe they don't do as good of a job of highlighting how humans navigate unexpected errors and seek out new problems. This is

because algorithmic machines cannot feel and process emotion the same way that humans do. There are certain drives and motivations that stem from emotional responses that machines can only imitate, and so certain creative aspects are underrepresented in these analogies. Referring to the balance between mechanical and creative aspects of epistemic processes, evolutionary epistemologists currently seem to overvalue rationality and logic and undervalue epistemic creativity.

Emotions' first role in epistemic creativity deals with innovative problem-seeking. In my previous chapter, a case for creativity was established using the evolutionary epistemologists themselves. To reiterate, Campbell discusses how a sort of creativity must be incorporated in our epistemic activities and he quotes Paul Souriau to support his point. They both contend that logical methodology can only get us so far because it deals with "already existing discoveries," (Souriau, pp. 17-8). When we seek out new problems to inquire about, we are not aware of what we are discovering and how to resolve the problem, and so an innovative creativity is required to best address this process of epistemic inquiry.

In *The Logic of Scientific Discovery,* Popper agrees with Campbell and Souriau and expresses necessity of creative elements within inquiry:

> "[M]y view of the matter, for what it is worth, is that there is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense," (Popper, p. 8).

Popper refers to Henri Bergson, a French philosopher who, in *Creative Evolution*, wrote about a philosophy of evolution that centers "intuition, which partakes in certain characteristics of both instinct and intellect, while creating new ways of addressing what each must leave out," (Bergson, p. XIV). On similar grounds, Popper notes how a creative, or instinctual, intuition is prompted in discovering new ideas. He follows this with a quote from Einstein that places the discovery of new ideas in an intuition "based upon something like an intellectual love (*'Einfühlung'*) of the objects of

experience," (Popper, p. 9). While it isn't explicitly described where these creative intuitions arise from and how they are propagated, Popper's formulation seriously implies the role of emotions, specifically an 'intellectual love', that motivates and informs humans of new ideas and epistemic pursuits.

Secondly, emotions can help us better understand and navigate epistemic error when we inevitably reach them. Under the evolutionary epistemologists' framework, all human knowledge processes entail fallibility, and so we are prone to making epistemic errors in our inquiry process. In the previous section, I argued that emotions play a role in navigating and recalibrating our epistemic aims. I also discussed how emotions can inform us on what steps to take after an epistemic error. Both are facilitated and substantiated by epistemic fallibility and how epistemic fallibility affects our knowledge processes. In this section, I tie epistemic fallibility and creativity together by positing that emotions' inherent relationship with creativity also establishes strong grounds for its significance in also understanding and facilitating epistemic fallibility. Because of this relationship between epistemic creativity, epistemic fallibility, and emotions, I am more so expanding my argument from the previous section and placing creativity as the product or catalyst of navigating epistemic fallibility.

Like epistemic fallibility, emotions' role in epistemic creativity is best understood with a more encompassing framework of epistemic norms that clearly incorporate the process of inquiry. This is because epistemic errors can also occur during the inquiry process, not just at the end of an inquiry.[15] Conversely, traditional epistemic norms situate belief justification as the most epistemically

[15] Epistemic errors can be understood as acts leading to an epistemically erroneous conclusion.

relevant part, underappreciating the nuances of how one got to their belief in the first place.[16] As it stands, more traditional epistemic norms fail to appreciate the contextual values and phenomenal experience of epistemic processes, also leaving emotions out of the (evolutionary) epistemic picture painted thus far.

Because of emotions' inherent ties with creativity and fallibility, there is a plausible relationship between how these three facets interact. As described in the previous section, emotions can be informative of when we make an error (which could be an epistemic feat to achieve at all!) and can motivate further inquiry and action via a sort of intuition. Additionally, both creativity and fallibility require innovation because of its uncertain nature, and these characteristics are amenable to the process of inquiry. That is, both creativity and fallibility are characterized by an uncertainty towards how to go about an epistemic process of any inquiry, and this makes it likely that it plays a role within our, often uncertain, epistemic processes.

At points in which we need to recognize and understand our epistemic error during the inquiry process, creativity and fallibility seem to play an important role, and I contend that emotions tie these two facets together well: the creativity facilitated by emotions informs us, albeit not in a necessarily rational or logical form, of when we are epistemically faulty and how we can (or should) redirect our epistemic aims considering such error. This is what I mean when I say considerations of what we may not be able to know or describe logically will ultimately better inform us of what we are able to know more efficiently: the creative intuition that steers the path of knowledge processes cannot be accurately described in a logical manner but, nonetheless, an epistemic investigation of it

[16] Certain views, like reliabilism, place the process of inquiry as important. I am sympathetic to views like reliabilism if it is more cognizant of one's phenomenal experience, affect, and how it impacts the process of inquiry. Thank you to Jeff Kasser for this consideration!

will bear epistemically useful towards matters that can be better and clearly formulated in a logical sense.

I place emotions' role in epistemic creativity as dealing with both epistemic motivation and epistemic efficiency. Emotions play a role in epistemic motivation because my current arguments for epistemic creativity overlap with my previous arguments for epistemic fallibility in knowledge processes. Because of this, they necessarily overlap in epistemic roles. This is most salient in situations in which one must navigate an epistemic error. In such cases, emotions influence both fallibility and creativity through motivating the knower towards certain epistemic ends. For example, emotions can inform when one reaches an epistemic error (and, thus, be fallible) and how one can progress towards their epistemic aims using epistemic creativity. In my view, epistemic creativity must be understood in relation to emotions to facilitate the growth of knowledge. Emotions must be considered in this equation to adequately understand how epistemic creativity works and how different approaches, such as conventionally non-logical or non-rational approaches, can ultimately better inform us of how we can best achieve our epistemic aims.

2.4. Summary

This chapter laid out the main arguments of my thesis, which is to defend emotions' place within evolutionary epistemology. I started by painting the evolutionary history of emotions and explored how it related to our epistemic processes. Emotions impart knowledge that is important for evolutionary means on an individual level and on a collective level (e.g., social knowledge). Incorporating emotions will shape and redefine 'evolutionary rationality', as emotions' coevolution and involvement with rationality are inextricably bound together.

From this, I revisit epistemic fallibility and epistemic creativity and consider how emotions can redefine these facets that are so prevalent within evolutionary epistemology. Emotions necessarily

contribute to our epistemic fallibility, and their role is better understood when we include the process of inquiry as epistemically relevant. Epistemic fallibility, while commonly seen as epistemically detrimental, is actually a useful marker for epistemic competency (you must understand the concept enough to err about it) and can further progress and develop our knowledge through its recognition. Consequently, we ought to see emotions as relevant and important within epistemic fallibility and I argue that incorporating emotions here will only contribute to our aims of evolutionary epistemology. Evolutionary epistemologists' understanding of epistemic creativity is also enhanced with the consideration of emotions because creative acts are largely charged by emotions. Emotions particularly inform us of how to start new inquiries and how to recalibrate the inquiry process upon making an epistemic error.

Both epistemic fallibility and epistemic creativity prioritize the process of inquiry rather than the belief itself or justification of the belief. Because epistemology is centrally concerned with beliefs and justification of beliefs, the value of emotions becomes underappreciated; this is because emotions can play more salient roles *within* the process of inquiry and not so much on the justification of a belief. Understanding emotions in this way reframes and expands how evolution has contributed to the growth of human knowledge and how it is similar and dissimilar to animal knowledge. In the next chapter, I reiterate the implications of understanding emotions in this way. Epistemic processes influence numerous aspects of human living, and I elaborate on some of these influences and show how incorporating emotions can affect these aspects in epistemically productive ways.

CHAPTER 3 – FUTURE DIRECTIONS OF ACCEPTING EMOTIONS IN EVOLUTIONARY EPISTEMOLOGY

3.0. Implications and Application of Emotions

In this last chapter, I discuss implications and future applications of accepting my central thesis that emotions are within the scope of evolutionary epistemology. I start small by reiterating and elaborating on implications within evolutionary epistemology in reference to our aims of evolutionary epistemology as defined by Popper. I then widen my scope to discuss implications within epistemology in general. Specifically, I expand on how emotions are seen with epistemic relevance and importance already within other subfields of epistemology like feminist and social epistemology and explore the other two epistemic roles of emotions from Brun & Kuenzle that were only briefly described before: its influence on non-propositional content and epistemic access to facts and beliefs. The last two sections concern how this framework could be applied to enhance and broaden our understanding of empirical studies on decision-making and pedagogy. Epistemological implications can encompass and affect many aspects of human experience, and I hope to highlight how vast and influential adopting this framework can be towards other aspects, both within philosophy and academia and within everyday contexts of living and experience.

3.1. Implications within Evolutionary Epistemology

In the beginning of Chapter 1, I defined the aims of evolutionary epistemology as being comprised of two features described by Popper. These two features are: 1.) to understand the growth of human knowledge and 2.) to understand the continuity and discontinuity of human knowledge with animal knowledge. In this section, I reiterate more thoroughly how emotions have been shown to influence

these features individually. Because evolutionary epistemology was my target of interest, this section further elaborates and restructures arguments I have already made in my thesis to more clearly define the implications of accepting emotions within the scope of evolutionary epistemology. As such, I will be referring to my previous chapter and the arguments I made there, just in a different way.

The growth of human knowledge can be explained and understood through a variety of ways. As I understand it, its growth can be explained by examining the process of inquiry and how it is facilitated and propagated. My main point of contention was that epistemic norms traditionally center justification of belief and its mapping onto the truth. Consequently, this focus on the endpoints of reasoning underemphasizes the relevance of understanding the entire process of inquiry from start to finish. I argued that expanding these epistemic norms to include the inquiry process would lead to a more accurate description of the growth of human knowledge. Understanding the growth of knowledge implies the understanding of the whole inquiry process, as questions of why I opted for one inquiry over another and my methodology of getting to my belief seem integral in grasping the full scope of how our knowledge is acquired and developed.

Understanding the continuity and discontinuity of human knowledge with animal knowledge can also be tied together with emotions. Namely, universal facial expressions that convey certain emotions and information have been found and these expressions have been argued to be evolutionarily significant by Darwin, LeDoux, among others. Being cognizant of emotions and how they affect other epistemic facets will contribute to understanding human knowledge and its relation to animal knowledge due to their common starting point: both animals and humans clearly express certain emotions towards certain situations and think and react differently in light of such emotions. For example, cats can express contentment and happiness by purring and rubbing onto your leg

upon your arrival, while humans can express these emotions by smiling and hugging. Importantly, starting with emotions in the first place illuminated the similarities and dissimilarities regarding the consequent information that arises from such emotions. The similarities are that each species respectively does some expression for feelings of contentment, but they differ in how they are presented. Emotions are a biological and innate feature that has persisted with many species over many years. Its influence impacts many organisms, and I argue that this common thread is illuminating of the epistemic similarities and differences between humans and animals.

Essentially, incorporating emotions within the scope of evolutionary epistemology seems fitting and conducive towards achieving the evolutionary epistemologists' aims. Popper places two aspects as crucial in epistemology. In this section, I have reiterated how emotions can contribute towards each aim and how the implications of emotions within evolutionary epistemology are promising on such fronts.

3.2. Implications within Epistemology & Philosophy

Expanding the scope of evolutionary epistemology also allows for more interaction and discussion in between subfields and for more novel exploration of epistemic matters. Subfields like feminist epistemology and social epistemology already discuss and place emotions as an important feature of human epistemic activity. My defense of emotions in evolutionary epistemology sheds more light on how these disciplines interact with each other in newfound and productive ways. Emotions can also contribute to epistemology in other ways that have not been thoroughly discussed yet. Specifically, Brun & Kuenzle list five epistemic roles that emotions can play, and I only discuss three of those five roles. In this section, I expand on two prospects that illuminate implications of emotions being seriously considered within epistemology: I suggest how feminist and social epistemology can interact with my newly proposed evolutionary epistemology and develop the remaining two roles

explicated by Brun & Kuenzle: non-propositional contributions to knowledge and understanding and epistemic access to facts and beliefs.

In the Stanford encyclopedia article for evolutionary epistemology, there are two main sections. The first section deals with its history and issues, and the second section deals with formal models (Bradie, Michael and William Harms, 2023). Crucially, there is no discussion of any emotion or any socially mindful considerations and their interplay with evolutionary models. One important implication of accepting emotions within evolutionary epistemology is that it creates more opportunity for understanding evolutionary epistemology using tools from other subfields that already utilize emotions. Conversely, those subfields can also interact with evolutionary epistemology in newfound ways and utilize epistemic tools from evolutionary epistemology, as well. Emotion is one common thread between these fields that encourages more discussion between them.

Feminist epistemologists clearly understand emotions as being epistemically relevant. One common reason for them seeing emotions as such is that observation in general is affected by emotions. Despite the prevalent assumption that observation is an unbiased and passive process, feminist epistemologists argue otherwise. In *Love and Knowledge,* Alison Jaggar writes:

> "Observation is not simply a passive process of absorbing impressions or recording stimuli; instead, it is an activity of selection and interpretation," (Jaggar, p. 160).

She continues to explain emotions' significance in observation:

> "...the individual experience of emotion focuses our attention selectively, directing, shaping, and even partially defining our observations, just as our observations direct, shape, and partially define our emotions," (Jaggar, p. 160).

Jaggar emphasizes that observations are not passively obtained but implicitly affected by our own sentiments and values. She describes how emotions and observation are influencing each other, and so emotions are thought to underlie the selective process of observing. Under this framework, sensory perception in humans is fundamentally formed through emotions. When we also understand

sensory perception as being evolutionarily fundamental, it bridges these concepts together in a profound and dynamic way. I think that the implications of understanding this relationship through emotion is auspicious to both feminist epistemology and evolutionary epistemology.

The sentiment on observations being less passive than construed can also be seen in more moral matters. Margaret Little defends the role of emotions and desires in moral considerations by also pushing back on the passivity of observing. In *Seeing and Caring*, she writes,

> "The view that obtuseness is caused *only* by the obscuring effect of emotion and desire, though, operates on the faulty picture that seeing is passive: were we just to clear our pathways of distorting affect, the information would come right in. This, of course, is not how it works," (Little, p. 121).

Like Jaggar, Little describes how emotions are important in moral matters because they are embedded within the moral landscape; moral theories that fail to incorporate affect are, thus, viewing the moral landscape inaccurately. While she discusses the moral implications of emotions in observation, she also explicitly ties epistemology with ethics:

> "I think that such feminist approaches to epistemology are of particular importance in the moral domain, for morality is precisely the arena in which a proper epistemic stance demands the presence of what we might call an appropriate [desire and emotion]," (Little, p. 134).

While there are different implications for moral matters, Little relies on emotions and its epistemic significance for her construal of the moral landscape, and she does this by understanding observation as an active process of selectively seeing and caring about certain things. The evolutionary significance of emotions in this scope not only broadens and informs us of epistemic matters but it further broadens and informs us of how we construct moral knowledge and beliefs in interesting and newfound ways. These sorts of relationships are ones that are more salient once we appreciate the role of emotions within evolutionary epistemology first and, again, seem fruitful to study.

On a wider scope, accepting emotions within evolutionary epistemology can also suggest more epistemic roles for emotions. The two roles not discussed yet, non-propositional contributions to knowledge and epistemic access to facts and beliefs, are both defended by response-dependent properties, such as boredom, interest, amusement, and so forth. Response-dependent properties are necessarily determined by emotional responses to them; feeling certain emotions *determines* what is deemed boring, interesting, amusing, and so forth (Brun & Kuenzle, p. 18).

Emotions can be a clear way towards recategorizing epistemic standards in a way that is more amenable to non-propositional knowledge. This understanding places emotions in the forefront of categorizing certain cognitive states, as well as certain standards of inquiry and warrants (Brun & Kuenzle, p. 25). Stronger claims about emotions' role in epistemic access to facts and beliefs can also be somewhat substantiated (although not completely) by referring to response-dependent properties, as they are facts that are only epistemically accessibly through emotions (Brun & Kuenzle, p. 23). Understanding these considerations with an evolutionary underpinning illuminate these roles more vividly, or it may redirect our attention towards other relationships that have not been considered yet. In summary, placing emotions in the scope of evolutionary epistemology implies a plethora of new causal interactions and relationships that establishes newfound relationships and future inquiry within epistemology, between subfields of epistemology, and within other disciplines like ethics.

3.3. Empirical Applications in Decision-Making

Accepting my defense also implies how empirical studies ought to be done and how future studies can inform my defense (for better or for worse). There are a multitude of ways I could approach this, and I focus my attention on decision-making and emotions; this is because decision-making is a prevalent feature in epistemic processes and has gotten a lot of attention recently in empirical

research on emotions. To make a decision *is* to utilize cognitive capabilities and undergo an epistemic process. For example, when I decide whether I want to go grocery shopping or whether I want to go watch a movie at the theater, there are epistemic matters that are necessary to consider in order to make that decision: I'd have to ask questions like do I have enough food at home to sustain myself or whether I had enough money in my budget to go the movie theater. More recently, there has been garnered attention on how affect and emotions can influence epistemic rationality and logic in decision making. In this section, I go over a meta-analysis of studies in emotion and decision-making compiled by Lerner et al. to better frame our discussion and then introduce a particular framework of development within this field of study as discussed by Antonio Damasio in *Descartes' Error*. Appreciating the role of emotions in a more traditionally logical and rational domain like decision making was found to be extremely epistemically fruitful. I contend that this makes it more likely that it will be fruitful in other domains that are predominantly seen as logical, and that future research would be illuminating about such dynamics between emotions and these other domains.

There are some common distinctions made between types of emotions in relation to decision-making. The first one is integral emotions, or ones that "arise from the judgment or choice at hand," (Lerner et al., p. 802). These emotions can work in conscious and unconscious ways and tend to influence the decision heavily. For example, I might be nervous about getting into a philosophy PhD program (I am). Because I want to go to graduate school, I might get more anxious about it and that might make me more inclined to apply to a lot of schools. Another type of emotion is incidental emotions. These are emotions that, usually unconsciously, carry over into other matters that are not pertinent to the emotion to the matter at hand; anger is a common example of an emotion that tends to bias other issues outside of the ones causing the anger, (Lerner et al., p. 803). Furthermore, they summarize how emotional valence is only one of several dimensions that can influence decision-making, implying that there are other dimensions of interest, (Lerner et al., p. 804). As

considered in my thesis, emotions seem to fundamentally alter the inquiry process in epistemically relevant ways; emotions do *something*, and that something has caught academic attention only recently, especially within empirical studies.

The intersection between philosophy and empirical studies is a promising direction for research concerning our mind and brain. One example of an epistemically successful investigation of emotions and decision-making from an empirical perspective comes from Antonio Damasio. In *Descartes' Error,* Damasio refers to neuroscientific empirical studies to supplement his broader philosophical claims about how emotions affect decision-making. The first few chapters of his book compare the famous case of Phineas Gage with a more modern-day case of someone who he calls Elliot. To condense the two cases very roughly, both suffered from damage in the prefrontal cortex. Specifically, the ventromedial area, or the more internal areas of the prefrontal cortex, was compromised and severely impaired their decision-making. Importantly, neither seemed to suffer in other certain domains of knowledge like social knowledge, elementary reasoning, and working memory. Rather, it affected both in the latter stages of decision-making, like when you are explicitly making a decision, (Damasio, p. 50). Upon doing a series of tests on Elliot, he concludes,

> "I was now certain that Elliot had a lot in common with Phineas Gage. Their social behavior and decision-making defect were compatible with a normal social-knowledge base, and with preserved higher-order neuropsychological functions such as conventional memory, language, basic attention, basic working memory and basic reasoning. Moreover, I was certain that in Elliot the defect was accompanied by a reduction in emotional reactivity and feeling," (Damasio, p. 51).

This sets the foundation for Damasio to defend his broader claim that emotions necessarily impact the rationality utilized in human decision-making (and not only in negative ways). Using empirical data of patients who suffered from specific neurological conditions, we can better determine what mechanisms are influenced by emotions and decision-making and how the two relate by studying the causal relations of the condition to its outcomes. Here, Damasio focused on patients suffering from damage in the ventromedial region of the brain and evaluated how the damage altered their

decision-making and found that there was a connection between regulating emotions and its impact on decision-making. Later in the book, he argues for the stronger claim that emotions necessarily act on the decision-making process and that its 'rationality' is only understood within the scope of our emotions and affect in the first place; he dubs this as his somatic-marker hypothesis (Damasio, p. 173). Crucially, Damasio places emotions as a fundamental feature of how our rationality is construed in decision-making.

Damasio's framework is only one example of a successful epistemic application of emotions to the rational domain of decision-making; there are many empirical avenues of inquiry that open when one becomes sympathetic towards emotions' role in epistemic activities generally. I briefly introduced a specific field of empirical study concerning emotions and decision-making through neuroscientific data and gave a glimpse into the fruitful epistemic implications of adopting such a stance. I believe that other domains, like emotions' role in the development of scientific methodology, can be further developed in similarly fruitful ways with emotions in mind.

3.4. Broader Applications

Lastly, I contend that the scope of emotions and their epistemic influence extends into broader considerations of education and pedagogy.[17] In this section, I paint an example of how emotions can change the trajectory of pedagogical standards using studies published in academia concerning emotions in education. Then, I will describe some scenarios in a pedagogical setting in which mindfulness towards emotions dramatically alters epistemic consequences. This is all to suggest that there are many broader applications of my thesis that are epistemically promising to pursue.

[17] There are multiple ways to attend to this. I only discuss the domain of education and pedagogy, but we can imagine how emotions can influence other domains like parenting and social relations.

In my thesis, education and pedagogy deal with different aspects of the learning process: I understand education as the process of gaining knowledge in some way; particularly, I focus on education occurring in more formal school settings. Pedagogy concerns the act of teaching someone knowledge. In other words, we can imagine a student being primarily involved in the process of education, while the educator is primarily involved in the process of pedagogy.[18]

Like my argument about emotions' role in evolutionary epistemology, it is argued in education academia that emotions are important but undervalued in pedagogical standards akin to how epistemic issues have tended to focus on rationality and objectivity. Both place creativity as an important byproduct of emotions and argue for more consideration of emotional influences in our pedagogy. In *Moods, Emotions, and Creative Thinking: A Framework for Teaching*, Douglas Newton writes:

> "When planning and teaching, attention is generally given to cognition while the effect of mood and emotion on cognition is ignored. But students are not emotionless thinkers, and the effect can make a difference to their thought. This is particularly evident when attempting to foster creative thinking," (Newton, p. 34).

There is an inherent link between emotions and creative thought, and emotions are thought to impact how students interact and respond to knowledge and their thoughts; this line of thinking aligns almost exactly with my defense of how emotions can contribute to epistemic creativity in evolutionary epistemology.

Specifically in pedagogy, Newton summarizes that positive-feeling emotions (e.g., happiness) tend to promote creative thought and problem solving. He describes how feeling safer and more comfortable might facilitate experimentation and creativity. For example, feeling more positive can mitigate anxiety about judgment of trying a new thing and, potentially, failing at it (Newton, p. 37).

[18] This is not to say that students are not concurrently teaching others and the educator or that the educator is not concurrently learning from others! I just simplify it and focus on the primary processes allocated to those roles: educators are generally supposed to teach, and students are generally supposed to learn.

Negative-feeling emotions (e.g., anger) can also foster creative thought but in a different way; negative emotions can produce more cautious and focused analysis that is more cognizant of detail and can motivate epistemic pursuit (Newton, p. 37). Again, this sentiment was defended by me in the previous chapter when I discussed the sort of social knowledge imparted by emotions and Lordes' work on anger. While Lorde does not argue that anger encourages any of these specific traits, they both illustrate how a seemingly negative emotion contributes in epistemically useful ways.

While both positive and negative emotions can promote epistemically beneficial creative thinking, they can also result in epistemically detrimental creative thinking. For example, emotions that encourage the propagation of conspiracy theories and that ignore evidence against the conspiracy theory are surely epistemically detrimental. In a classroom setting, a student experiencing negative emotions that cause them to lash out to other students for disagreeing might be seen as epistemically detrimental. In response, I have tried to emphasize throughout the thesis that a balance between logical and rational thinking and emotional and creative thinking is necessary in successful epistemic processes. Nevertheless, both the positive and negative influences of emotions should prompt the educator to consider pedagogical implications of emotions in the first place, either to enhance emotions' role in epistemically beneficial creative thinking or to mitigate emotions' role in epistemically detrimental creative thinking.

Implications of emotions in pedagogy are discussed by Newton when he introduces a pedagogical framework that is mindful of "the stream of affect" (Newton, p. 39). One significant implication of incorporating emotions in pedagogy is that it assumes a more diverse group of interest. That is, every student is going to have a different affect and, thus, a different way of processing and developing knowledge (Newton, p. 39). When an educator becomes mindful of this diversity, they can implement methodology that is more considerate of mitigating the negative effects of emotions

in learning while encouraging epistemically fruitful creative thinking within the group. Not only does this encourage mindfulness of diversity within a group but also it also encourages mindfulness of how pedagogical frameworks differ between groups of identity generally. Whether it is ethnicity, cultural upbringing, or age, students are going to be emotionally influenced by these facets of their lives and these influences are going to inherently impact how they process knowledge in the classroom setting. While this sort of mindfulness might seem messy and unclear, it also is more accurate to how learning actually works and allows us to begin to understand the messy interactions in the first place. Importantly, understanding emotions in the context of pedagogy and education can help educators start to understand the ebbs and flows of how emotions (and the experiences and identities that influence our emotions) impact knowledge acquisition in a classroom setting, as it inevitably does.

In the section, I have only discussed one broader application and implication of including emotions within its scope. There are many other domains of living that will be affected by emotions. I think this makes sense because so much of our phenomenal experience is embedded and framed within our emotions and how we feel all the time. When emotions are seriously considered in epistemic matters, it bridges our phenomenal experience of living to how we acquire knowledge, and this relationship influences a wide array of areas, from pedagogy to parenting to relationship-building. The applications of emotions in this way are, consequently, immense and still largely unexplored in a lot of contexts that it is necessarily relevant towards.

3.5. Conclusion

In this chapter, I have given an overview on implications and applications of accepting my defense that emotions play an epistemically significant role in the acquisition and development of human knowledge. I start by reiterating my defense of emotions within evolutionary epistemology and

discuss further implications and interactions with other domains of philosophy, like feminist epistemology and ethics. I then discuss examples of how incorporating emotions within empirical studies and broader applications of life, such as education and pedagogy, can promote the subsequent epistemic aims within each facet.

Within my thesis, my defense of how emotions contribute to the aims of evolutionary epistemology is formalized via Popper's definitions: it aids in understanding the growth of human knowledge and understanding the continuities and discontinuities of human knowledge with animal knowledge. Epistemic fallibility and epistemic creativity are defining properties that stem from evolutionary 'rationality' and are prioritized by evolutionary epistemologists as fundamental and inevitable to epistemic activities. I defended that emotions contribute to these properties by imparting, prioritizing, and motivating certain knowledge. Importantly, emotions help us understand, process, and react to uncertainty in epistemic processes, in humans and other species alike. They can help in the discovery of new problems and navigation of epistemic errors that ultimately inform us on the growth of human and animal knowledge.

Both epistemic fallibility and epistemic creativity are more prevalent and salient within the process of inquiry rather than the process of belief-justification. Shifting the epistemic norms to incorporate more features of inquiry, such as how an inquiry begins, paves the way for a clearer sense of how emotions can contribute to epistemic matters. Evolutionary epistemologists hold that all our knowledge processes entail both epistemic fallibility and creativity yet fail to investigate the mechanisms of either features. I've attempted to show how emotions are integral in the mechanisms of both epistemic fallibility and creativity, and that a more thorough investigation of such mechanisms will only aid in the epistemic project. Accepting that emotions ought to be studied within evolutionary epistemology implies newfound relations and inquiries not only promoting the

aims of evolutionary epistemology, but also implying exciting epistemic prospects for other facets of life both inside and outside of philosophy academia.

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