THE EVOLUTION OF IMAGINATION

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INTRODUCTION

Consider Miles Davis stepping up to the microphone and sculpting a powerful musical statement—complete with furtive tonal secrets, inside jokes, and blasting climactic summits—all composed in real time over a hard-swinging rhythm section. Now consider a hip-hop freestyle rapper performing an unrehearsed verse, and each word takes him dangerously closer to the inevitable closing rhyme—his options for a coherent finish dwindle even while he builds his final sentence. Or consider a comedy improv team—like The Second City—taking a few cues from an audience and collectively riffing it into a coherent story punctuated by belly laughs and irony. Now envision a team of digital engineers doing some "outside the box" brainstorming, as they work to invent a new app. Or slow it down and we find the Darwins and Einsteins of science testing and trying fresh theoretical solutions to the nagging mysteries of nature.

The shared element in these diverse activities is the enigmatic engine of human creativity, the improvising imagination. Human culture itself is impossible without the imagination, and yet we know very little about

I.1. Trumpet player Miles Davis (1926–1991) is considered one of the great improvisers of several jazz traditions, including cool jazz, hard bop, modal jazz, and jazz fusion.

it. Why does a story evoke a whole world inside us? How are we able to rehearse a skill or an event in our mind's eye? How does creativity go beyond experience to make something altogether new? And how does the moral imagination help us improvise our way toward a more ethical society?

Artists often consider the imagination their unique provenance, but the imagination drives everything from engineering, marketing, cosmology, economics, and ethics. Aristotle described the imagination as a faculty in humans (and most other animals) that produces, stores, and recalls the images used in a variety of cognitive and volitional activities. Even our sleep is energized by the dreams of our involuntary imagination. Immanuel Kant saw the imagination as a synthesizer of sensibility and understanding. Freud saw it as a release system for antisocial desires. And recent neuroimaging reveals that a prefrontal and temporal lobe circuit enables us to project ourselves into different times and places—the imagination is our inner time-traveler.

We live in a world that is only partly happening. We also live in copresent simultaneous worlds made up of "almosts" or "what ifs" and

"maybes." At the moment that I'm failing at some task, for example, I'm simultaneously running a success scenario of my actions, and this imaginary reality is creating real emotions inside me. Or I see this open grassy field here, but also see (through imagination) my future home that will be built on this empty plot. Imagination is the possibility maker. It is the home of hope and regret.

What is the relationship between improvisation and imagination? The issue is fraught with ambiguity. The philosophical and the artistic traditions have considered the imagination as a mental faculty that mediates between the *particulars* of the senses (e.g., luminous blue colors) and the *universals* of our conceptual understanding (e.g., the judgment that Marc Chagall's blue *America Windows* is beautiful or sunrises are beautiful). Philosophers (from Aristotle through Kant, and beyond) have focused on the

I.2. Hip-hop artists often "battle" each other with freestyle rap techniques. The artists take turns delivering spoken poetry that has not been rehearsed, and often incorporate spontaneous commentary on the opponent's appearance and skill level (not to mention the dubious character of their respective mothers).

unique forms of judgment that arise from imagination. But I will argue (respectfully) that this tradition over-intellectualizes the imagination.

The philosophers characterize imagination as a kind of *cognition* rather than embodied *action*. This common mistake demotes the imagination to a kind of weak knowledge—making it derivative or secondary to "real knowledge." From Aristotle to the present, philosophers and scientists have tended to think of real knowledge as a process of seeing through the particular cases to the universal rules or laws that govern them. This search for formal properties ignores sensual particulars in favor of conceptual universals. For example, we see that this man has a snub nose, this other man is bald, this man is young, this one old, this one hungry, this one tall, et cetera, but eventually we see past all this to recognize their shared defining features: they are all rational, featherless bipeds. The common defining features are the real objects of knowledge, according to this long-standing tradition.

Against this universalizing approach, the imagination stays close to particular sensual impressions—the snub nose and the baldness of the men are more relevant (e.g., the hunchback is not subtractable from Quasimodo of Notre-Dame). Often the imagination adds many traits rather than subtracting them, as in the case of flying pigs, talking animals, and composite hybrid creatures like mermaids, griffins, and even gods like the Hindu Ganesh. The imagination is interested in the particular. If imagination captures a universal—and it frequently does—it is emotional rather than conceptual, as when a theatrical tragedy (rich with particular detail) captures a universal aspect of grief or love.

I will draw upon the philosophers when their ideas about the imagination are relevant, but my interests are closer to the common layperson's use of "imagination" as a creative power. Creativity must be broadly understood as an intellectual, artistic, and even bodily form of investigation and expression.

Improvisation, in my account, will be the main *activity*, method, or operation of the imaginative faculty. Improvisation, more accurately, is not just what the imagination does, but is the adaptive meeting place between the organism and the environment. The improvising imagination draws on internal resources (i.e., thoughts, feelings, behaviors) and environmental resources (i.e., this tool, this pigment, this rock) in service of various end goals. As we will learn, the rapid activity of real-time prob-

lem solving is where improvisation shines, but a common cognitive architecture underlies the slower, cool-headed forms of imaginative planning as well. Improvising a can opener and designing one take place in two different timescales, but both processes draw on similar mind-body equipment.

It is rare for imagination to engage in free-play synthesis with no purpose whatsoever. We like to think of imaginative improvisation as completely unfettered, but it rarely is. And if it were, it would be more like uninteresting noise. As spontaneous creativity inevitably becomes more bounded by specific goals (e.g., technology, procreation, play, catharsis, prediction), it comes under greater executive control. My team riffs and brainstorms ideas, for example, but those riffs are channeled toward the different goals depending on whether my team is a corporate group, a scientific research team, a TV drama's writers, or a baseball team. We break improvisation into conventional taxonomies or headings, like humanities or fine arts or sciences, but the "mechanics" or processes of the underlying creativity share many common features.

The activity of improvising furnishes us with a fresh model for grasping how the imagination works, and one that does not fall victim to the overly intellectual approach. The intellectual or overly "cognitive" approach to the mind considers thinking as a kind of internal talking. The inner conversation of our thought is bound by language structures and functions—our thinking is a rapid blather of propositions. According to this dominant cognitivist view, imagining and other forms of thinking are ways of bringing together representations (like memories and concepts) into novel combinations, governed by linguistic grammar. But I will argue that the imagination is not information processing. The binary logic of computation, so effective in artificial intelligence (AI), is the wrong starting place for understanding the imagination. It's not wrong because we should all be "mysterians" about the mind and ascribe to it supernatural miraculous powers. It's wrong because an algorithmic approach fails to grasp the emotional and bodily basis of imagination.

We should think of "imagining"—the verb form, rather than imagination as a mental faculty. In this way we'll see greater connection between improvisation and imagination. Ultimately, however, these relatively unconscious processes have been hidden from any direct examination and only glimpsed obliquely or inferred from their finished creative products.

Thinking of the imagination as a *process* is more consistent with brain science as well. There is no imagination organ buried in the neuroanatomical structures of the brain. Several candidates for location have come and gone, most popular of which is the idea that the right hemisphere houses imagination. But data suggest no clear localization of creativity, and the most that can be said with confidence is that communication between brain regions is very high in imaginative people. The brain activity during the creative process is widely scattered, and we will learn that imaginative improvisation draws on many systems (e.g., motor, imagery, language, emotions, etc.).

Using other philosophical traditions (e.g., phenomenology, pragmatism, biosemantics, etc.) and recent scientific research (e.g., Ap Dijksterhuis's Unconscious Lab, affective neuroscience, etc.), I will argue that improvisation (spontaneous creation) is the fundamental process that underlies downstream achievements of both scientific and artistic imagination. Moreover, the improvising imagination has more access to knowledge (more epistemic power) than most modern philosophers, scientists, and even artists have been willing to consider.

We are always engaged in mental improv, but the stakes seem low because most of us are not doing it onstage in front of an audience. And while high-risk, onstage improvisation brings unique emotional and cognitive ingredients, we are all in dangerous territory whenever we strike out toward new intellectual and social terrain. The danger is, of course, also the attraction. Playing a jazz solo or a cadenza seems like high-stakes improvisation, but try parenting, marrying, soldiering, or feeling your way around a new religion. Real life is also high-stakes improvisation.

In this book, I will take care to explore archetypical cases of human improvisation—general intelligence processes that probably came online before the Upper Paleolithic (before 50,000 years ago), but remain with us today in culturally transformed processes, including music, social interaction, storytelling, religion, and technology. These examples will help to clarify the complex relationships between improvisation and imagination, and hopefully give us a privileged glimpse into the unique nature of our evolved primate minds.[1]

The improvising imagination is one of the little-explored phenomena that uniquely unify the humanities and biology. In it, we find the cre-

ativity that first emerged in our adaptive innovations (e.g., technological and social advancements), our involuntary free-play compositions of dreaming, our adaptive mythologies, and our highest human artistic achievements.

It is common for some evolutionary psychologists to reduce the mind to a set of computations (domain-specific problem-solving circuits) and project them into the Pleistocene era. Our mind, according to this modular approach, is a series of specific circuits or modules that evolved to solve specific problems—for example, avoiding poisonous plants is a mind circuit, detecting people who cheat is a mind circuit, finding a fertile mate is a mind circuit, and so on. However, this view of highly specialized circuits is heavily contested. Our improvising skills and our imaginative powers, for example, almost certainly grow out of general intelligence capabilities, not specific modules. Indeed, our improvising mind is the very opposite of a hardwired module or circuit, because it cannot be dedicated to one or two functions and seems available to all manner of problem-solving experiments. *Improvisation is the anti-module.* I will articulate sensible scenarios of early adaptive imagination, as corroborated in comparative primate studies, anthropology, childhood developmental psychology, and social psychology. But I will also give great weight to the unique semantics of culture and the humanities proper, all the while keeping track of the cognitive, social, and emotional prerequisites that evolved to get us here today.

Humanities scholars have long argued that imagination allows us to enter the life and mind of another person or people, giving us the realization of common humanity, moral understanding, and tolerance.[2] Our improvisations as a virtual other *self* require cognitive structures for projecting identity and difference, as well as emotional systems undergirding care and empathy. Philosophy will help articulate these faculties and functions. Moreover, beyond any evolutionary justification, aesthetics (as an autonomous discipline) reveals which kinds of stories work well or badly, which kinds of images and melodies move us or fail, and what makes an improvisation beautiful, ugly, or sublime. My approach will be pluralist, not reductionist. As a philosopher, part of my job is conceptual engineering—informed by the latest evolutionary science. Tracking the evolution of improvisation requires me to reverse-engineer a contemporary skill into its ancestral parts and capacities. But I will try to validate

these findings with evidence from the life sciences and the humanities, and my claim is that many of these ancestral capacities are still available in our contemporary creative activities.

Books about creativity have tended to fall into one of three genres. On the one hand, there have been the breathless and overreaching feel-good paeans to famous entrepreneurs and successful CEO creatives. This kind of book is crammed with amusing but shallow factoids and over-interpreted fMRI studies, all wrapped in a vaguely inspirational glaze. Next, we have the how-to books that give artists a series of exercises to unblock their creative flow. These books are either therapeutic or instructive, or both, and seek to nurture the joy of our inner prodigy. The third genre is the impenetrable academic baffler, chock-full of erudite and cryptic references to Foucault and the hegemonic phallocentric horizon of being, but otherwise devoid of illumination.

This book, by contrast, will be a broadly philosophical exploration of the origins and meanings of human improvisation and creativity. Fans of those other books will hopefully find much of interest here too, but this project is more foundational.

So, what is new and possibly groundbreaking in this book? Perhaps the most unique aspect is that I am reversing the traditional order of things, both logically and chronologically. Improvising did not emerge recently as some rarified elite employment of otherwise pedestrian symbols and behaviors. It was, instead, the driving force in our natural history. Our ancestors' forms of communication were prelinguistic, embodied gestural modes that served social needs. These mimicry forms of communication presumably emerged from affective/emotional adaptations that were long under construction in mammals. Grooming, body language, motherese, gesture, play, and other learned nonlinguistic communication preceded the cognitive revolution that language instigated. But contemporary cognitive science and evolutionary psychology have failed to take the primate social niche, and even the body, seriously.[3]

I will be arguing that the manipulation (improvisation) of information-rich perceptions/memories/image schemas/bodily gestures is born out of our primate social, emotional needs. Our intellect is a product and servant of our social life, and the improvising imagination—our early intellect—gave us the behavioral/mental scaffolding to organize and manage

our experience long before words and concepts. The improvising imagination typifies the flexibility of human mind, but the dates and the proximate triggers of such flexibility remain somewhat obscured in prehistory.

Following anthropologist Steven Mithen, I argue that a crucial feature of *Homo sapiens*' mind is "cognitive fluidity."[4] This fluidity breaks down the dedicated brain circuitry that ties one action response to one stimulus. Our minds become less machine-like because we can entertain counterfactual images and enlist alternative responses. Most evolutionary psychologists claim that the cause of this cognitive fluidity was the development of language (in the late Pleistocene), because language provides an obvious syntactical/grammatical system for manipulating representations. This system seemed to be the perfect girder network for expanding the inner head space of flexible cognition. But more recently, Mithen has argued that another system—namely, music—coevolved in parallel with language and gave pre-sapiens similar ways of projecting possible futures.

My argument takes this insight one step further, suggesting that, more than just music per se, a suite of creative abilities—dance, image, music, gesture, et cetera, which are more proximate to the body than language—built an inner space and behavioral space of options that freed *Homo* from the more deterministic patterns of other hominids. These creative improvisation skills emerged from earlier mammalian habits that manage resource exploitation and social cohesion, and they were emotionally (affectively) driven (i.e., habits like grooming and play fighting). Play, for example, would be selected for because it allows mammals to take threats (and dominance) off-line and rehearse for them in safe environments. And such proto-imagination play is done largely through the body, without much cognitive motivation or even understanding. From such lowly origins, a discernible thread can be traced all the way to Einstein's reputed claim that "play is the highest form of research."[5]

Some scholars have pursued the embodied metaphorical structures *within language* itself, and their work is important evidence that meaning is rooted in the body (not the head).[6] But I am more interested in exploring the evolutionary period before explicit language, as well as our contemporary access to that prelinguistic mode of meaning. I'm trying to explore the phase of mind *above* purely behaviorist stimulus-and-response, but *below* linguistic metaphors and propositional meaning. This histori-

cal moment (probably initiated during the early Pleistocene, circa 2 million years ago) is replicated or recapitulated, I believe, in the processes of our contemporary improvisational activities. The improvising musician, dancer, athlete, or engineer is drawing directly on the prelinguistic reservoir or meaningful communication. A music improviser or even a backpacker traveling in an exotic land without knowing the local language has to tap into that ancient call-and-response logic of body language and emotional expression in order to navigate properly. We try this move and watch for a response, try that move and watch. We dodge and parry this incoming gesture, accept that one. Flying by the seat of our pants, in these cases, is not just some *analogy* to prelinguistic communication—it is the thing itself.

This may well be the most controversial aspect of the book—that we might all have regular access to the ancestral mind. My thesis is that we have some direct access, albeit murky, to prelinguistic *Homo* intelligence, and this subjective experience can be intersected with the scientific methodologies of anthropology and evolutionary psychology. My job will be to expose the reader to some of this fascinating new research in the human sciences and reveal the connections with our own imaginative experiences. Trying to infer whether Neanderthals were cognitively modern from evidence of their ancient funerals is a worthy research program, but I want to augment such approaches with a systematic introspection of our own nonlinguistic consciousness. There is nothing spooky or mystical about this approach. I will be trying to articulate the dynamics of our embodied improvisational activities.

My approach is part of a growing research movement that seeks to ground meaning (biosemantics) in the embodied interaction of social primates. As great apes, we humans almost certainly engaged in the kind of subtle, antiphonal, body-language communication that we see throughout all social primates. Primate psychologists, like Louise Barrett, for example, are starting to track the malleable interaction networks that build up slowly in the course of development, giving primates the proximate lexicon of signifying gestures that will ultimately serve the bigger functions of dominance and submission, mating, alliance, food sharing, provisioning, and so on.[7] My argument is that we, too, operate in these embodied gestural systems of meaning much more than we usually acknowledge. The reigning paradigm in both the humanities and the sci-

ences is that meaning is linguistically grounded—propositional, inferential, and largely indicative. My argument is that this level of meaning rides on top of a deeper and older level—bodily, associational, and largely imperative (normative).

Art making is a realm that actually demonstrates these deeper lexicons of social communication. Jazz is a great case study of this realm of meaning, but it is just a token of a capacious type of adaptive human mind. Collective art making, especially in real time, manifests call-and-response meaning, but even solitary imaginative improvisation (the painter or writer) internalizes the social interaction within the practitioner.[8] In some cases, the improviser is "talking to herself" (generalizing a social other) as she composes an artwork—and while such work is more linguistic (propositional and representational), many art-making scenarios entail an inner "conversation" that is much more image based, impressionistic, embodied, and even liminally unconscious.

Call-and-response is one of the oldest improvisational techniques, as is synchronization of our melodies and our body movements (like in dance). These are ancient procedures for cementing communities, captured in performances that express emotion and draw out emotion. Such techniques allow us to explore open-ended options at the fringes of social and technological rules. Eventually such socially constrained exploration evolves into more and more off-line experimentation, growing into forms of thinking with images, with sounds, with gestures.

Our primate cousins have impressive abilities (grounded in the cerebellum) for sequencing motor activities—they have a kind of grammar for processing inedible plants into edible food, for example. This is a level of problem solving that seeks order (and "banks" successes and failures) between the body and the ecological potentials. I will argue that this kind of motor sequencing is the first level of improvisational grammar. Following this foundation, another level of image-schema manipulation—like mental rotation and eventually image narrative—piggybacks upon body grammar. And finally, only much later, did we start thinking with linguistic symbols.

Computational theories of mind may resonate with our late Pleistocene linguistic thinking, but not with our earlier image cognition. We encode and manipulate image schema and gestural schema, and thereby form the basis of subsequent metaphorical meaning. I suspect that it is

this thinking with images, sounds, and gestures that kicks off the cognitive fluidity marking our psychological modernity. As Eric Kandel puts it in his *Age of Insight*, "Perhaps in human evolution the ability to express ourselves in art—in pictorial language—preceded the ability to express ourselves in spoken language. As a corollary, perhaps the processes in the brain that are important for art were once universal but were replaced as the universal capability for language evolved."[9] I submit that the pictorial and gestural languages are still with us, and when we quiet our discursive consciousness long enough—like in improvisational activities—we can still converse in these more ancient tongues.

Besides the biophilosophy approach, this book draws upon my learning in both Western and Eastern wisdom traditions, and promises to be a cross-cultural investigation. I have had the good fortune to live, study, and teach in Cambodia, Thailand, Laos, Vietnam, and China. I have significant experience in the Western educational paradigm that treasures innovation and imagination, as well as a Chinese paradigm that prizes structure and mastery of time-worn rules and precedents. These contrasting civilizations are in a contemporary conversation about the value of the improvising imagination for future education. So, in addition to the evolutionary origins, we will also look at the possible future of improvisation as an engine of cultural success.

I've taught creative young people at a fine and performing arts college for twenty years, and I've researched creativity for decades and road-tested ideas in my classrooms. But more importantly, I've been a professional jazz/blues musician for twenty-five years, having the privilege of playing all around the country with some of my heroes—including Bo Diddley, Buddy Guy, Koko Taylor, B.B. King, and countless other great musicians. I've also worked as a professional illustrator, designing books, magazine articles, and websites. These experiences give me an insider's perspective on improvisation and help guide my exploration of both the inspiration and craft of creativity.

I've chosen to weave the entire book with the story of a specific jazz performance. The quintessential American form of improvisation, jazz, is a perfect paradigm—organized, flexible, adaptive, emotional, logical, and occasionally chaotic. *The Evolution of Imagination* is a jam session in six

chapters. But don't worry if your jazz or musical vocabulary is not up to speed. I'm more concerned with the dynamics below the surface of any one example of improv. The jazz description will focus more on the social experimentalism of group performance and not music theory per se. Most of what we'll find at work in a swinging jazz combo can just as easily be found in a pickup basketball game, product development team meeting, political diplomacy session, or tribal hunting party.

Each chapter will trade between two dominant melody lines: our real-time, in-the-moment uses of improvisation, and the origin and evolution of those imaginative powers. It will be an ontogenetic (individual development) and phylogenetic (species development) concert. How do we meaningfully dance today, for example, and how did the practice evolve in the first place? How do we use storytelling today, for example, and how did storytelling itself originate? How do I improvise in my daily life today, and how did improvisational thinking itself evolve in our ancestors?

"I asked, 'Do you have an electric dermatome?'" she recounted, hoping to use the surgical instrument commonly used in the United States to produce uniformly thin slices of skin for grafting. "They said, 'Yes,' and handed me a 12-inch-long knife."

DOCTORS WITHOUT BORDERS SURGEON SHERRY WREN, IMPROVISING WHILE TREATING AN EMERGENCY PATIENT IN CHAD, AFRICA

What we did . . . you couldn't ever write down for an orchestra to play. That's why I didn't write it all out, not because I didn't know what I wanted; I knew that what I wanted would come out of a process and not some prearranged shit. The session was about improvisation, and that's what makes jazz so fabulous. Anytime the weather changes it's going to change your whole attitude about something, and so a musician will play differently. . . . A musician's attitude is the music he plays.

MILES DAVIS

: ONE :

THE SECOND UNIVERSE

COUNTING OFF

The upright bass player asks the pianist for an E. The note rings out amidst the clinking highball glasses and the audience murmurs. He winds his tuning peg slowly to find where the pitch warble unifies into an even tone. The tenor sax player wants to hear a C note, honks briefly, and then adjusts his mouthpiece until the note trues. The drummer downs a shot of whiskey and throws the lever on his snare drum. He feels the weight of the sticks in his hands and considers switching to brushes instead. He decides to wait, wondering what the first tune will be, hoping it'll be an up-tempo song and not a ballad.

The pianist rolls up his sleeves and cycles through some minor chords, realizing the middle octave F# key is sharp. He winces and resolves to work with it anyway. No choice. Meanwhile the guitar player adjusts his amplifier, tweaking the treble dial and checking it against the idiosyncratic acoustics of the room.

The musicians are working through an ancient ritual of collective

music making, adjusting their specific instruments and getting them in harmony with the others. Also, they are readying their bodies: limbering the right muscles, stretching the tension out of some, and tightening others, cracking knuckles, clearing throats, and tuning their eyes and ears to each other and the room of spectators. In short, the human imagination is slowly assembling its ingredients before improvisational combustion.

The piano player waves his hand and everybody leans in.

"Let's play the old Van Heusen tune 'Imagination.'" Heads nod; the tenor player smiles. "But don't play it like the Ella ballad. Let's speed up and swing it—"

"Wait," the bassist interjects. "I don't think I know the bridge on that one."

"Don't worry," the guitar player says. "Just follow me—you'll get it."

"One, and two, and three, and . . ."

: : :

We're off. Something as simple as a count-off is deeply complex when we consider the cognitive and even bodily anticipation required to communicate and then create a melody and rhythm. The musician creates a one-measure virtual reality of what's coming, and everyone has to feel it together to embark on the real-world version that audiences can enjoy. The count-off is an imaginative act that produces the future—it starts actualizing one groove from the myriad potential interpretations of the jazz standard "Imagination." The ability to "get ready, set, go" is unique to higher animals. It allows us to prepare and create what's coming next, rather than just responding to stimuli.

Predators excel at the metaphorical count-off because it helps them anticipate and catch what's coming or going. Long before the count-off was a mental preparation, it was a bodily preparation—getting our muscles and limbs ready, our heart racing, our game face on. The earliest form of imagination, in the embodied mind, is anticipation.

Now imagine you're on a Pleistocene hunting foray with your little band of *Homo erectus* tribesmen. Anticipation is crucial. The ability to throw a projectile and hit a moving target is an astounding piece of adaptive calculation—a crude first step of imaginative prediction. Throwing a projectile requires anatomical evolution (expansion of the waist, and a more twistable humerus) but also new cognitive/perceptual skills. The

hunter needs to simulate internally what the prey animal might do next. Other non-human animals make such predictions, but they do not hunt with well-aimed projectiles. And perhaps most importantly, all this cooperative action and predictive skill requires some kind of apprenticeship. My readiness potential has to be directed and educated. Our ancestors survived because an early imaginative culture helped improvise and transmit cooperative hunting and gathering.

Did the hunting party improvise their way to dinner by conceptually modeling the environment and drawing logical inferences about where the wildebeest or buffalo will be next? If so, they would have needed mental concepts and inferential logic to manipulate them. Or did they feel their way to each successive move by some simpler experiential technique—following a bodily rehearsed series of motor sequences? These sorts of questions will become paramount as we track the capacity for improvisation. But I'm getting ahead of myself. We first need to consider some fundamental properties of the improvising imagination.

SOME CRUCIAL INGREDIENTS

Improvisation is found in so many varied activities that it is difficult to isolate the essential or defining characteristics. We often *know* it, when we *see* it, but strict definitions rule out some good candidate activities. Too narrow a focus on MacGyver- or Rube Goldberg–type engineering may rule out certain features of musical improvisation, and vice versa. But if the definition is too broad, then *everything* becomes improvisation and we don't gain insight into the crucial elements. At the risk of missing certain contours of the phenomenon, I'll propose some key features of improvisation—with the Wittgensteinian caveat that such practices have a *family resemblance* to each other rather than a definite dictionary agreement. Many of these key features are so intimately related to one another, they cannot be entirely teased apart.

Spontaneity is a key feature. Improvisers are seemingly artless and natural, generating their work from within themselves. There is a notable freedom of process that produces novel responses to a situation in real time. Planning may be an implicit phase, but not particularly overt. Without spontaneity, the moves become predictable and the activity is rote rather than dynamic. In art, a lack of spontaneity creates artworks that are

stilted and mannered. Similarly, in social interaction, spontaneity saves us from overly scripted communication and robotic body language. Relaxing our expectations about formal rules of engagement often allows for a more authentic unrehearsed expression of feeling and a more receptive read of others' expressions.

Intuitive. The meaning of intuition is arguable, of course. The history of modern philosophy and theology has tended to contrast intuitive experience or intuitive knowledge as that which does not first enter through the five senses (the gateways of empirical knowledge). For that reason, it is sometimes characterized poetically as a sixth sense, as it delivers a knowledge state inside the subject without the usual perceptual mediation. But this view, favored by mystics of all stripes, can be contrasted with a more mundane (and scientific) approach to intuition. This more naturalistic use of "intuitive" describes the very subtle systems of animal awareness, mostly unconscious, that we all possess, such as body-position awareness (proprioception), personal space (proxemics), and arousal states that trigger instincts like fight or flight. They are physiological responses to environment, rooted in the central and peripheral nervous systems. Improvisers draw upon this reservoir as they act.

Adaptive. Improvisation that has no direction whatsoever will hold some interest for us later, but such aimless riffing (even the free associations of surrealism) eventually seek to fit (adapt) an organism to an environment, a structure to a function, a part to a whole. Even the most wandering free play of thought or gesture can be an exploration of the potential in a given material or scenario. Improvisation is often a research mechanism or method of adapting means to ends. In the 1920s, psychologists demonstrated how chimpanzees could stack boxes together and build poles to reach food.[1] Since then we've had countless studies revealing the engineering improvisations of primates and other mammals. Of course, humans are masters of repurposing materials to new functions—turning reading glasses into fire starters, dental floss into fishing line, and duct tape into everything else. The improviser's survival may not be at stake in all these cases of adaptation, but we can appreciate that good improv improves the organism or has that potential.

Resource deficiency is often a key feature of improvisation. The perfectly provisioned kitchen or toolshed has an implement for every eventuality. Perusing posh shopping magazines introduces one to devices like the

Grillbot Automatic Grill Cleaner robot and the Rosle Egg Cracker tool as well as the Parmesan cheese gouger. In this exclusive world, there is a preset tool and solution for every problem, but this is not the domain of the improviser. The improviser does not have the optimal resources needed for a given problem. And this paucity of resources is the very condition of creativity because it forces a kind of lateral thinking. From the survivalist who conquers the jungle with just the contents of his pockets, to the urban entrepreneur who entertains crowds of tourists with a bucket instead of a drum kit, the improvisers are usually short on supplies.

Various "junkyard war" competitions help students learn about design and engineering, by posing objectives (e.g., make a floating vessel) and then presenting them with suboptimal construction materials. Such challenges reveal the social aspects of improvisation, but also the paradox of resource deficiency. The worse off the materials appear to be, the more creative the competitors must become.

Natural or self-imposed disciplines. Chuck Jones (1912–2002) was one of the twentieth century's greatest animators, giving us Bugs Bunny, Daffy Duck, and Wile E. Coyote, to name just a few. As an imaginative improviser, working with the freest medium, he could make animals float in the air, fly through walls, and walk away from devastating injuries. In addition to great character development, his cartoons are captivating because he carefully constructed world rules or "disciplines" that he and the artists strictly obeyed in the creation of the stories. A few of his disciplines for the Road Runner and Coyote cartoons are listed in his book *Chuck Amuck: The Life and Times of an Animated Cartoonist*: "1. The Road Runner cannot harm the Coyote except by going 'beep beep.' 2. No outside force can harm the Coyote—only his ineptitude or the failure of Acme products. 3. The Coyote could stop anytime—*if* he were not a fanatic. . . . 6. All action must be confined to the natural environment of the two characters—the Southwest American desert." And so on.[2]

The creativity of the practitioner must be bounded by real or imaginary physics or rules that give consistency and predictability even to the most fantastical scenarios. The audience enters into these disciplines consciously or unconsciously and accords their expectations. This aspect—agreed-upon conventions—crosses many domains and media (e.g., musical genres have indigenous scales for improvisation). Even the most iconoclastic improvisational departures are in a relationship, albeit rebel-

1.1. It is common for jazz musicians to schedule gigs in front of audiences and then refuse to rehearse ahead of time. This will force them to bring their most skillful and responsive selves to the performance, and challenge the other players to do the same.

lious, with the conventional disciplines or rules. The disciplines keep improvisation from being nonsense.

Emergency or high-stakes conditions. Of course, many improvisations are successful under the low-pressure, no-stress conditions of leisure. Many musicians will successfully explore entirely new territory on their instruments when the audience is sparse and undistinguished, and many engineers will improvise their best work when the boss is no longer looking over their shoulder. But most accomplished improvisers recognize that they "up their game" when the stakes are high. Improvisers are not afraid of vulnerability, or at least they overcome their fear and regularly put themselves in vulnerable situations. It is common for jazz musicians, for example, to schedule gigs in front of audiences and then refuse to rehearse ahead of time. This will force them to bring their most skillful and responsive selves to the performance and challenge the other players to do the same. A little desperation and anxiety go a long way to focus the mind and the players in any collective project. And the no-rehearsal model also ensures that the performance will be a unique one-of-a-kind event, reflecting a cultural apotheosis (and possibly spiritual celebration) of the very moment of improvisation.

This last point brings us quite naturally to another important feature: improvisation is *simultaneously performative and compositional*. Whether it's building a house, a sermon, or a pop song, most projects entail a separate composition and performance phase. But improvisation combines these two phases. This is clear to see in things like jazz and comedy improvisation, where the practitioner is simultaneously expressing some idea or gesture and fitting it into a larger compositional framework (i.e., the solo inside a song, the riff inside the comedy sketch). One performs in a Janus-faced mode, looking inward to the next move and outward to the accruing arrangement. And, importantly, the composition is finished at every moment, because the improviser cannot stop to do things over again. Unlike in a recording studio or on an architect's drafting table, the improviser cannot erase. The phrases we try, as improvisers, cannot be taken back, and they go out into the social world as public gestures. Trying new things in improvisation is not a practice or rehearsal for performance, but the thing itself. Thankfully, there is a high tolerance in improvising communities for "warts" and "wrong turns."

If we switch from a jazz combo example to a hunting party, then we see that tolerance must have its limits too. A member of the hunting party who is always trying new hunting maneuvers can be an ineffective and possibly dangerous teammate. Much is made in anthropology literature about the freeloader problem, which is the challenge of dealing with a self-interested parasite member who won't carry his weight in a cooperative venture like hunting. But cooperative ventures need protection from the "overly creative" too.

In this context, we can see the vital importance of *reliable clichés* in improvisation. A good improviser has an arsenal of ready-made options to introduce into an immediate activity. Hunters have a division of labor, of course, but as individuals and as groups, they also have a series of reliable tricks to flush out, track, and kill prey. The improviser uses his clichés as scaffolding for subsequent deviations and novel moves, but introducing the right clichés at the right time is also an artful part of improvisation. The great musicians have signature riff and phrase preferences. The comedian has her go-to impersonations and prefabricated jokes. The athlete has her automatic patterns of forehand here and drop shot there. The improviser must both develop meaningful clichés (for storage) and unpack or discharge them meaningfully (i.e., the right clichés at the right time).

Some of this reliance on clichés or prefabbed formulae is necessary

because it's not possible to create spontaneously all the time. Moreover, improvisation is usually a social interaction, and formulaic moves allow others to make smart predictions about your movements—a crucial aspect of cooperative projects like hunting, music making, and even religious ritual.

From all of the above, we can already see that improvisation is *functionally promiscuous* or *unlimited*. It's a skill set that operates in any domain. It's a way of doing things rather than a specific body of information. As an end in itself, improvisation has all the pleasures and satisfactions of any intrinsic delight. The improvised comedy skit needs no utilitarian grounding to help us enjoy and appreciate it. But improvisation is also a *means*, and as such it can take up with almost any teleological goal. Improvisation is the engine of trial-and-error learning.

Like Darwinian evolution itself—comprised of chance mutation and natural selection—improvisation often tries or proposes a "solution," and then the environment selects for or against it. Improvisation is an unsystematic generate-and-test method for getting maximum grip on one's situation. My strange bait caught the fish, for example, so I learn. My joke got no laugh, so I learn. My improvised blade cannot cut this hide, so I learn. My offering to the gods was rejected, so I learn. Out of these trial-and-error experiences, domain-specific patterns and rules emerge, but improvisation doesn't deduce its solutions so much as fumbles toward them. And, save for certain problems that require exact precision (e.g., certain mathematical ones), the art of fumbling can solve many mammalian survival challenges.

Improvisation is rule governed in many cases, but casually so. It is a *flexible practice* that sees rules as elastic. Improv is serviceable rather than optimal, imprecise rather than exact, flexible rather than rigid. If I'm playing with a pianist who plays an A-minor chord, then I can play a solo in a pentatonic scale for a bluesy flavor, and I can throw in a Dorian modal phrase for darker shades and a natural minor or Aeolian mode, but I cannot do much with a C# note unless I'm deliberately flaunting the rules for dissonant purposes (and that might be fine too). The point is that the improvisational maneuvers already exist within a system of received conventions, but the constraint is usually gentle. Flint knapping had conventions that governed its practice for hundreds of thousands of years, and they were tight enough to ensure success but loose enough to admit

maverick maneuvers and even virtuoso innovations. The Mozart of flint knapping must have broken many rules, but was also presumably recognized as a positive force rather than a mere rule breaker.

One common form of improvisation is the *mixing*, or *hybridizing*, *of frames*. Pastiche can be seen as a major player in the improvising imagination. Once the person grasps the relevant rule systems or genre conventions (the "frames"), she can create novel meaning by mixing those usually separate systems. The great cellist Yo-Yo Ma will regularly drop phrases from a country-and-western genre into a classical improvisation, or a Bach convention into a Chinese folk song, and so on. But larger genre mash-ups have also dominated the pastiche artworks of the postmodern era, wherein crime noir frames (dominant in the 1940s) are blended with science fiction narratives (e.g., *Blade Runner*, *The Matrix*), or rock and opera are melded into unprecedented configurations (e.g., *Tommy*, *The Wall*, *American Idiot*). Two or more well-entrenched frames can be fused to create a fruitful new platform for further experimentation. Architects mix classical and modernist frames together to produce strange new facades and structures like the Bundeswehr Military History Museum in Dresden, and ballistics innovators mix grenade technology with rifle technology to produce novel weapons like the M203.

Within this broader tradition of pastiche, we might recognize a subbranch of *humor* that often colors improvisation. Putting a blues riff in a polka tune or quoting Shakespeare in a comic strip can be extremely funny, in part because the juxtaposition is so unexpected. In improvisational music, the performer is often creating something for two audiences—the cognoscenti (the other musicians) and the hoi polloi (the general public). Humorous frame bending and mixing often arise as players try to surprise each other, as well as the larger audience. Of course, there is little humor or irony in high-stakes survival improvisation, but in many other forms of experimentation, we find a self-reflexive awareness (a knowing wink) of the process itself.

In addition to all of the above, the improviser is *emotionally or affectively charged*. Affect is a more physiologically oriented way of describing emotions, and we need to recognize that improvisation is steeped in moods, passions, and subjectively felt motivations. Common speech sometimes uses "affect" to describe a person's *expression* of emotion, but the more accurate scientific meaning is different. An affect is a specific

bodily change that can give rise to a conscious feeling but need not. My emotion of anger, for example, is a subjective psychological experience that I can report, but it rests upon a specific physiochemical change in the brain and body (i.e., catecholamine neurotransmitters are released and produce a burst of energy, heart rate and breathing increase, blood pressure rises, hormones like adrenaline spike, the amygdala becomes very active, and so on). Affect, then, is a way of describing this somewhat impersonal physical process at the root of our felt emotion. Each primary emotion—like fear, lust, anger, and so on—has a specific brain-body pathway of chemical change that precedes or simultaneously constitutes our conscious emotion. In many cases we can use the words "emotion" and "affect" interchangeably, but occasionally it will be helpful to recognize the formal difference.

The improviser is goaded or energized by an emotion of seeking or wanting, and he is driven by the all too familiar feeling of *desire*—having an "itch" that he is desperate to "scratch."[3] Desire is motivational, but many negative affects (e.g., performance anxiety, nervousness) also accompany the starting phases of improvisation and must be dealt with by the practitioner.

The affective systems that push improvisers at the beginning of their experimentation are joined by other emotional systems later in the process. As I try new moves, I read the effects of those moves, and my assessment of feedback (from the material or social environment) is emotional, bodily, intuitive. Often the speed of improvisation itself makes slower, deliberative, cognitive appraisal of feedback impossible, and the improviser must rely on real-time gut reactions.

In addition to the affectively charged origins and in-process phases of improv, we would be remiss to ignore the exultations and miseries of the completion phase. Successfully completing an improvisation is a kind of emotional ecstasy that many people will recognize. One doesn't need to be a performer to feel the sense of triumph that accompanies any successful project of flying by the seat of your pants. Effectively navigating a Beijing grocery store, for example, when you only know a handful of Chinese words can be a true joy. And, of course, creating a powerful musical solo or proposing a winning idea in a business brainstorm session can get a person high for days. Contrariwise, the failures are charged with powerful negative affects as well.

Lastly, I want to begin an articulation—often returned to in this book—of the prerequisite *imaginative faculties* behind improvisation. Improvisation requires some basic aspects of the mammal operating system, like perception and emotional or affective circuitry. But we also need short-term and long-term memory storage and fast retrieval. We need classical and operant conditioning or associational systems. We need some kind of representational system that can take images, events, and ideas off-line (decoupled from immediate experience) and manipulate them for novel results. We need social learning abilities that undergird skill acquisition like materials crafting, food processing, language, and even moral norms.

Crucially, improvisation is not possible without some sort of human *freedom*, or way of discriminating and preferring some behavioral options over others. This means we need a specific kind of biopsychological operating system that makes such flexible maneuvers possible.

Some animals cannot improvise. As philosopher Daniel Dennett noticed (and many cognitive scientists repeated), the *Sphex* wasp has very rigid, constrained behavioral options.[4] When the wasp returns to its burrow with food for its grubs to feed on, it first leaves the food on the threshold and enters to check the burrow. Devious scientists experimented on *Sphex* behavior by repeatedly moving the food a few feet from the threshold whenever the wasp went inside the burrow. Each time the wasp exited the burrow, it went through the exact same behavior protocols—dropping the rediscovered food at the threshold again and entering the burrow. The scientists repeatedly moved the food (up to forty repetitions), but the *Sphex* never learned to simply bring the food into the burrow directly and remained trapped in a seemingly endless action loop. The creature follows its biological script with great fidelity, but it is not a good improviser. By comparison, humans are virtuoso improvisers, and I will try, in this book, to articulate the suite of biocultural powers that make such virtuosity possible.

As I mentioned in the introduction, a few philosophers (notably Aristotle and Kant) have long recognized a faculty of imagination, but the parameters of its work and power have been narrowly circumscribed. I will broaden the notion by treating it as a mammalian set of aptitudes (comprised of bodily gestural lexicons, cognitive representational abilities, perceptual knowledge, the memory-emotion complex, cultural

mechanisms of informational and emotional management, and, finally, rational decision-making powers). There will not be a specific "faculty" that houses all these powers, but rather a network of interconnecting systems. In this sense, my use of "faculty" is shorthand for a suite of affective and cognitive capacities that I will spell out as we proceed through the book.

Unlike most philosophers of mind and cognitive scientists, I'll be arguing that the heavy lifting in human creativity is borne by the emotional brain (limbic system) rather than the rational brain (neocortex). The imaginative prerequisites that make us *Homo sapiens* rather than *Sphex* emerge out of our primate heritage.

THE CAPTAIN OR THE MUSE?

The freedom problem (above) has produced a bogus model of imaginative improvisation—namely that there is a conductor, or *captain* (sometimes called "homunculus"), rationality inside me, and this captain does the decision making. The captain is an executive controller who winnows down the myriad options and commits us to a line of action. In writing a story, this model might make sense, because the author can slowly consider alternative scenarios for a plot or character and then rationally choose the best. In music improvisation, however, such a captain is presumably weighing all the note choices in the relevant scale and choosing the best note for a phrase. But the sheer speed of musical improvisation alone is enough to make us doubt the accuracy of this captain model, at least in regard to some creative activities.

On the other hand, the mysterious loss of self that most improvising practitioners experience has produced a second dubious model—the *muse* model of supernatural possession. We've romanticized creativity so completely that we've ended up with an impenetrable mystery inside our heads. Following the Greeks, we still think of our own creativity as a muse that descends upon us—a kind of spirit possession or miraculous madness that flooded through Van Gogh and John Lennon, but only trickles in you and me. We may not literally believe in muse possession anymore, but we haven't yet replaced this romantic view with a better one. After the great Texas guitar improviser Stevie Ray Vaughan died, Eric Clapton paid tribute by describing him as "an open channel . . . music just flowed

through him." And when I worked as a blues musician in Chicago, playing with greats improvisers like Buddy Guy and B.B. King, I saw plenty of this "channeling" firsthand. It didn't happen all the time or even most of the time, but when it did, it was something special.

We recognize that creative activity decenters the ego. This gives us some skepticism about the agency involved in imaginative improvisation. Recently, the new science-based mysterians (devotees of "the singularity" and other worshippers of transcendental wonder) have sounded almost theological in their claim that the cosmos is channeling through us, when we are in a hypnotic "flow" experience of sublime nature.[5]

What's happening during this muse-like loss of agency, however, is rarely explored. We tend to equate this loss of executive control (i.e., the "captain" jumps ship) with a pseudo-religious ecstasy and give up any further analytical approach. But throughout this book, I will break with the creativity mystics and try to say something about the unsayable. When we are in this decentered muse state, for example, we are often engaged in a highly associative process—what William James might call the "stream of consciousness." The imaginative faculty is proficient at image associations, for instance, but also the faculty is extremely adept at mixed-media associations. When we imagine, we blend pictures and propositions, memories and real-time experiences, sounds, stories, and feelings. The imagination is a multimedia processor that jumps laterally through connotations, rather than downward through logical inference. Much of this is unconscious, which is why the muse simile is so powerful, but this phase is followed by a *reentry phase*, where the free associations or stream of consciousness is brought back under executive control and integrated into the more focused projects of the person (i.e., the return of the "captain").

The captain and muse models are fairly unhelpful if taken alone, but we must recognize them as exaggerated aspects of creativity. Taken together, they give us two important phases of the imaginative process. Improvisation is a Janus-faced phenomenon, and we will have to keep an eye on its two faces. In fact, it is probably a three-faced deity (like a Buddhist Asura) because the reentry phase is not just a return to quotidian coherence, but a new development (having productively waded in the stream of consciousness).

METAPHYSICAL IMAGINATION

We think of the imagination as powerful, and in chapter 6 we'll consider its ability to shape the social world. But previous eras also believed that imaginative acts could transform physical matter directly. From the ancient alchemical doctrines of Hermes Trismegistus through the esoteric societies of the Renaissance and early modern period, the imagination was seen as a uniquely powerful tool for manipulating nature. The hermetic and gnostic traditions viewed the world as a series of isomorphic associations, with aspects of the human form (shape, ratios, humors, etc.) as microcosmic mirrors of the macrocosmic world. In the same way that Plato's demiurge gave shape and form to the physical universe (*Timaeus*), our imagination acted as a god within—able to create worlds of meaning and even causal changes in the physical world. Paracelsus (1493–1541) called the imagination the "inner star," aiming not at fantasy but at the Platonic Ideas (*eide*). A common belief among the pagan alchemists was that the trained imagination could capture the departing soul of a person, transform that soul into a good force (a pseudo-deity) or bad (demon), and then replant the soul into a statue or icon image (thereby giving the spirit a new body). In this state—as a magical artwork—the icon, if benevolent, could be appealed to for help with health problems, or, if demonic, for help with vengeance against enemies.[6]

A less magical tradition of imagination still conceived it as having direct causal force in the world. More than just a mirror of experience and inventor of fantasy, the imagination had a mechanical aspect too. More than just a mental faculty, the imagination had intimate causal connection with the whole body. If you weren't careful with your imagination, you could harm yourself and others.

Before the rise of scientific embryology and sophisticated developmental biology, we did not fully understand the causal relationships between a parent's mind/body and their offspring's mind/body. Truth be told, we still don't know a lot, and the recent field of epigenetics suggests that there is much still to learn. Nonetheless, we feel justified in thinking of the imagination as a purely psychological "mixer" of previously received perceptions, and these inner mash-ups have no physical effects beyond the brain of the imaginer. Through most of history, however, and even in contemporary cultures, people have seen the imagination as

a metaphysical force. If I imagine disturbing things, for example, will my baby be harmed or even distorted?

Such a metaphysical imagination is more reasonable before the clear split between subjective and objective experience, brought about by modern philosophy and science (e.g., Descartes, Galileo, Kant, and so on). Without a clear boundary between subjective and objective experience, a fantastical experience of supernatural creatures could be easily read as a supersensory encounter or discovery of reality, albeit weird and rare (e.g., spiritual intuitions of the divine realm). Our tendency is to read such an experience as strictly subjective and psychological, but that is a recent tendency. If an inner mash-up of forms and feelings could be an encounter with the real, then it's a small step for some to believe that such mash-ups also cause real physical changes in the world (either by some action at a distance or some subtle matter mechanism). And it was not just mystics who entertained this possibility.

As recently as Darwin's day, scientists debated this very question. An 1865 letter to Darwin begins, "I have today come across a very remarkable case of animal monstrosity with the particulars of which you will I think be interested." George Maw, a Shropshire tile maker and amateur botanist, had sent the letter.[7] Maw relates a recent pig birth at the local inn, in which a sow gave birth to ten normal piglets and one deformed creature resembling a little elephant. The monstrous offspring possessed a distinct trunk-like proboscis and the ears and mouth of an elephant. The creature was born alive but the mother smothered it, and the local pharmacist pickled it in a jar of spirits.

Maw's letter to Darwin asks advice. Does Mr. Darwin think it is interesting enough for scientific analysis? Should Mr. Maw purchase the monstrosity and bring it to the Hunterian collection in the Royal College of Surgeons in London? Maw has investigated the case thoroughly and eagerly shares a tentative theory about the genesis of the elephant pig. A day or two after the sow was impregnated, he explains, a traveling menagerie passed through town and one of the elephants tried to attack the sow. She was terror-stricken by the experience, and Maw suggests that this trauma distorted the embryonic pig gestating within her. The frightening impression of the aggressive elephant traveled through the imagination of the sow and imprinted a disfiguration upon the forming matter in utero.

The theory of monstrous maternal impression was widespread from

the pre-Renaissance through the nineteenth century. It was often employed to account for organic distortions in human as well as animal embryology. One is reminded of Joseph Merrick, "the Elephant Man," who claimed that his own unfortunate condition was the result of his pregnant mother being frightened by a dangerous elephant in 1859. In his autobiographical pamphlet, Merrick says, "I first saw the light on the 5th of August, 1860, I was born in Lee Street, Wharf Street, Leicester. The deformity which I am now exhibiting was caused by my mother being frightened by an elephant; my mother was going along the street when a procession of animals were passing by, there was a terrible crush of people to see them, and unfortunately she was pushed under the elephant's feet, which frightened her very much; this occurring during a time of pregnancy."[8] As superstitious and pernicious as this view of disability seems to us now, it was progress compared with the earlier theological view that abnormalities were punishments sent by God for sins of the parents.

Russian czar Peter the Great (1672–1725) celebrated all things monstrous and freakish in his early museum collections, and in some of his official proclamations he prohibited the killing of deformed children and requested that local officials send the "marvels" to his St. Petersburg museum. Obsessed with breeding giants and dwarfs, Peter looked more deeply into the science of teratology, the immediate mechanisms of deformation and variation. In one of his proclamations, he states:

> Ignoramuses think that such monsters are born from the action of the devil, which is, however, impossible for there is only one creator of all creation, and that is God. And the Evil One has no power over any living creatures. For monsters are the result of internal damage, of fear and the thoughts of the mother during her pregnancy, of which fact there are many examples. For example, when the mother is frightened, hurt or injured in any way the child will be influenced.[9]

A hundred years before Peter's psychologizing of monster embryology, the French surgeon and scholar Ambroise Paré (1510–1590) also emphasized the role of the mother's imagination in teratology. Paré started "rescuing" monsters from the melodramatic arena of spiritual and moral meaning, but failed to effect a complete revolution in monsterology and toggled between the highly superstitious and scientific. He certainly

paved the way for future medical scientists to study birth anomalies. Paré's book *On Monsters and Marvels* took a relatively empirical approach to monsters, preferring the collection and dissection of oddities rather than simply hearsay natural history. Paré listed thirteen established causes of monster births, including naturalistic causes like too much or too little seed, but also supernatural causes like "God's wrath."[10] Number five on his list was the imagination.

Paré describes a sad story of a girl whose body was "perfect and well-proportioned" save the fact that she had two heads. She lived for over twenty-five years, "which is not natural for monsters, who ordinarily live scarcely any length of time at all because they grow displeased and melancholy at seeing themselves so repugnant to everyone, so that their life is brief." This rare moment of recognition—acknowledgment of the inner psychology and subjectivity of the monster—is abandoned quickly and the pariah status is underscored in the rest of Paré's story. "This girl," he continues, "went begging from door to door for her livelihood, and people gladly gave to her on account of the novelty of such a strange and such a new spectacle. Nevertheless, she was at last driven out of the Duchy of Bavaria because she could spoil the fruit of the pregnant women by the apprehension and ideas which might remain in their imaginative faculty, over the form of this so monstrous a creature. It is not good that monsters should live among us."

Paré follows his ancient predecessors (i.e., Hippocrates, Aristotle, and Empedocles) in upholding a theory about the role of the mother's imagination at the moment of conception and in early gestation. If a woman in coitus is exposed to some frightening, disturbing, or just strong imagery (either through the senses or memory), then her offspring may be impressed upon by the offending image. Paré accepts the reality of a physiological process—one that begins as a disturbing sense impression and ends with a distorted fetus. He offers a few cases to illustrate his point, some of which strain his own credulity while others seem quite credible to him. Undermining his own embryonic empiricism, he cites the authorities of old. He tells of Queen Persina of Ethiopia, who together with the black King Hidustes mysteriously produced a white baby "because of the appearance of the beautiful Andromeda that she summoned up in her imagination, for she had a painting of her before her eyes during embraces from which she became pregnant." Likewise we are told of another

girl who was born as furry as a bear. Her unfortunate state was a result of her mother "having looked too intensely at the image of Saint John [the Baptist] dressed in skins, along with his [own] body hair and beard, which picture was attached to the foot of her bed while she was conceiving."

A more contemporary example is offered in Paré's story of a baby born in 1517 France with the face of a frog. When asked what the cause of this monster might be, the father of the child explained that his wife had been ill with a fever and had taken the curative advice of her friend. The friend offered a folk cure, saying that the wife should carry around a frog in her hand until the frog died—at which point she would be cured of the fever. "That night she went to bed with her husband, still having said frog in her hand; her husband and she embraced and she conceived; and by the power of her imagination, this monster had thus been produced."

From these cases, Paré, the medical man, offers some advice. It is important, he says, that women "should not be forced to look at or imagine monstrous things" at the time of conception or during the early formation of the child. But once the formation of the child is complete, no images or imaginings will have a detrimental effect upon the offspring.

Paré is drawing upon an ancient tradition that started in Aristotle's *Generation of Animals* and found full force in the writings of Albertus Magnus (c. 1193–1280).[11] This tradition explains conception and development as the impression of male "substantial form" (contained in semen) onto the menstrual blood or matter (contributed by the mother). This is in keeping with Aristotelian and later Scholastic metaphysics of hylomorphism. Forms become instantiated in matter, and this makes one animal different from another (our species definitions are meant to capture these different substantial forms). But the mind itself is, according to Aristotle, the "form of forms." The mind receives the forms of the natural world, not the matter (there's no room in my mind for the material world). My mind takes in a form of a tree (and manipulates it as a representation), not the tree itself. The imagination is the receiver and manipulator of these forms, and it must be pliant enough to receive the impression, but durable enough to hold the forms. From Aristotle to Albertus Magnus, it was thought that the imagination of women was more susceptible to unhealthy impression because the female mind was more moist. Excessive moisture made the imaginative faculty easily corrupted with frightening external images and inner ideations. This impressionability put the fetus at risk of malforma-

tion. Inner humidity "explained" certain kinds of monstrosity, but also the fickleness of females, who get impressed easily but lose focus because the mental substrate cannot hold the information properly.

These sorts of causal explanations may seem ridiculous to us, but they represent a naturalistic turn in the sense that they opened up possible research avenues. There may not have been a discoverable physiological *mechanism* that transmits disturbing sense impressions to the conceptus, but at least Paré didn't just throw up his hands and say "the devil did it." Invoking the imagination also indicates some sense of psychological effects; psychology can lead to very concrete manifestations (e.g., a deeply troubled woman can result in a miscarriage). In this respect, Paré seems to foreshadow psychosomatic theories that flourished during Freud's generation and beyond.

French philosopher Nicolas Malebranche (1638–1715) continued the exploration into metaphysical imagination, trying to bridge the dualism divide of mind and matter. The bond between mother and unborn child is the strongest that exists for humans:

> And although their soul be separated from their mother's, their body is not at all detached from hers, and we should therefore conclude that they have the same sensations and passions, i.e., that exactly the same thoughts are excited in their souls upon the occasion of the motions produced in her body. Thus, children see what their mothers see, hear the same cries, receive the same impressions from objects, and are aroused by the same passions.[12]

Malebranche illustrates the point with a recent specimen that "all of Paris has been able to see as well as me, since it was preserved for a considerable time in alcohol." A woman had been looking too intensely at a portrait of St. Pius and gave birth to a baby that resembled perfectly the face of the saint. The baby had the face of an old man, and even his forehead was shrunken due to the foreshortened angle of the portrait.

When a mother desires a pear too much, according to Malebranche, the pear shape (object of desire) will actually re-form in the extremely soft flesh of the embryo—distorting the body. The mother is spared this transformation because her body is no longer as soft and impressionable. Women are more impressionable than men, but less than babies.[13]

From Aristotle, through Ambroise Paré, to Peter the Great, the imagi-

nation played an important role in the naturalized tradition of pathological ontogenesis. Things began to change, however, in the first few decades of the nineteenth century. But breaking with such historical inertia was difficult. Mary Shelley's friend Professor William Lawrence (1783–1867) was an early scientific martyr in the demystification of pathology, especially the metaphysical imagination.

Shelley apparently added the moralizing anti-materialist tone to *Frankenstein* in later editions because she feared the same condemnation that her friend William Lawrence received. He had been suspended from the Royal College of Surgeons because of the radical materialism contained in his controversial book *Lectures on Physiology, Zoology, and the Natural History of Man* (1819). Fearing that her own book might be withdrawn, Mary Shelley tempered her original 1818 edition.[14]

Lawrence, however, paid a great service to embryology and laid to rest many popular misconceptions about monsters. Regarding the theory that a mother's imagination can corrupt the fetus, he asked: What sort of mechanical process could operate from the mother's imagination down to the womb, where it would then have to destroy the normally developing head and reconstruct a new monkey head or frog head or whatever? Furthermore, he stated, we have extensive evidence that women can suffer serious disorders (e.g., diseases, amputations, etc.) with no ill effect on the fetus, so frights and imaginings seem far too weak for fetal reconstruction.[15]

When George Maw wrote his 1865 letter about the elephant-pig monster, Darwin's response came quickly—and it provides us with insight into late nineteenth-century embryology and changing ideas about imagination. Darwin had toured the many monsters of the Hunterian collection in London, but he was convinced, after reading the Étienne Geoffroy and Isidore Geoffroy, that monsters were developmental glitches.[16] They were not "messages" or signs from the beyond, nor were they preformed in the germ. Instead, they were caused by environment. This environmental developmental view of monsters left open the question: Did the mother's imagination absorb and translate some shock to the piglet (perhaps via pangenesis), or did common mechanical causes distort the fetus because of environmental flux? The answer is in the rarity or regularity of such occurrences. In his response to George Maw, Darwin doesn't rule out the imagination thesis entirely, but he refers to Isidore Geoffroy's

work. Darwin writes, "The monstrosity of a proboscis-like prolongation of the snout occurs much more frequently as stated by Isidore Geoffroy than with any other animal; and therefore I presume is not rare." A pig trunk is, in fact, a common aberration and correlates with developmental patterns of craniofacial formation. Similar developmental glitches can be seen when the forward-most part of the brain (prosencephalon) fails to properly divide the eye orbits into two cavities and Cyclops anomalies occur. The pig trunk is a common teratology defect. Darwin says that he "must believe that the coincidence of the visit of the elephant and the birth of the monster was a simple accident."

Increasingly, monsters came to be seen as the result of pliable developmental causes, but the pliability was not like the radical folk version of maternal imagination. It wasn't the lack of an imagination-sculpting *mechanism* that doomed the theory of metaphysical imagination. After all, the nineteenth century lacked knowledge of other crucial mechanisms too, such as the mammalian egg and the genetic DNA unit of heredity, but science still held out for both. The metaphysical imagination just slowly died in scientific culture from a lack of significant correlations between mothers' imaginations and teratology cases. The connection was too anecdotal.

Setting scientific culture aside, however, folk belief in "imagination distortion" remains alive and well. When my Chinese wife was pregnant with our son, I was regularly told (by my in-laws and other Chinese relatives) that I should keep my wife calm and away from disturbing imagery. This advice was offered by highly educated urban professional Chinese, not uneducated rural villagers.[17]

In southern India, pregnant women are cautioned against looking upon temple decorations of lion figures or disturbing deities. "If she does," ethnographer Edgar Thurston says, "the tradition is that she will give birth to a monster." Thurston writes, "Some Hindus in Madras believe that it would be unlucky for a newly-married couple to visit the museum, as their offspring would be deformed as the result of the mother having gazed on the skeletons and stuffed animals."[18]

More recently, the *Ethnicity and Disability Fact Book*, updated regularly by the Multicultural Disability Advocacy Association of New South Wales, reminds us that many people around the world still believe that disabilities can be "caught" like a contagion by encountering other dis-

abled people or frightening events. "The idea that disabilities can be caught is quite common across the world. This results mostly in actions to protect pregnant women from seeing, hearing or touching people with disability or even their technical aids." In addition, disabilities are frequently blamed on "perception negligence" of the mother. "In the Philippines," the *Fact Book* explains, "a woman gave birth to a baby who was unable to move his limbs. Her explanation of her son's disability was that she had worked in view of a statue of a national hero during her pregnancy and must have caught the 'stiffness of the limbs.' "[19] In Ghana, women must not look at blood or monkeys or disturbing carvings. In Jamaica, mothers are advised against seeing a human or animal corpse. The same is advised by North American Indians, and Nigerian mothers are told to make sure that no ugly people walk behind them. Sami mothers in Lapland are to avoid conversations about deformity and avoid witnessing reindeer calving.[20]

All this superstition is easy to dismiss, and we're tempted to write off the maternal impression thesis as retrograde magical thinking. But as usual, these folkways contain deeper truths. We will not, I suspect, find any mechanism that translates bad thoughts or disturbing perceptions into monstrous babies, but we now accept the more general mechanisms by which maternal stress negatively impacts offspring.

Stressed mothers release high levels of cortisol and adrenaline into their systems. Ordinarily these hormones are useful for fight-or-flight adaptive responses to threats, but if their levels stay too high for too long, they can damage the mother's body and brain, and compromise the health of the child. Acute stress (like seeing something very disturbing) or chronic stress (like living in an unsafe environment) can bring unhealthy hormone levels into the baby's system. These changes can alter brain development and corrupt blood flow in the fetus, reducing oxygen levels and negatively impacting organ integrity. Moreover, a stressed mother tends to eat and sleep poorly, and these are not optimal for the baby's health.

Perhaps a little superstition about maternal imagination and monsters helped generations of mothers and babies stay healthier. As we enter a new kind of epigenetic paradigm, we may have even more reason to celebrate the paranoid preventions of prenatal monsterology. "Epigenetic" formerly meant embryological development from simple to complex

structure (as opposed to preformation), but the term has a new meaning these days. "Epigenetic" has been resurrected by biologists recently to refer to the newly discovered layer of molecular triggers and switches that ride on top of our genetic code.

The new epigenetics is rendering the old distinction between nature and nurture obsolete. It is also revealing how the mother's prenatal uterine environment can "communicate" features of the outside world to the baby's epigenome (switching system) and set new default traits that may last for multiple generations. For example, recent data from the "Dutch Hunger Winter" show an epigenetic switch for obesity. Nazis in 1944 Holland diverted food from the Netherlands to Germany. Longitudinal studies of the Dutch population have demonstrated that if a fetus was in its second or third trimester during this famine, the fetus "learned" that the environment was extremely poor in nutritional resources, so the brain/body adapted in utero by calibrating its physiology to aggressive conservation of incoming fat, sugar, and nutrition generally. The fetuses that were developing in this hostile uterine environment of the Dutch Hunger Winter automatically reprogrammed to store every bit of incoming calories. The result, many years later, was a high degree of obesity in the adults who were epigenetically changed during their fetal experiences. Lab testing on rodents has isolated the actual epigenetic switch for fat storage that can be turned on or off.[21] The point of this, for our purposes, is that maternal experience can have shaping influences (beyond genetics) on the gestating offspring—both short- and long-term influences. The developing fetus is unrolling a genetic program, but it is also a very plastic and impressionable system—open to real-time changes in the mother's experience.

None of this is meant to suggest that maternal imagination can distort embryos and fetuses in the traditional metaphysical manner. Science has not confirmed earlier magical thinking, and it probably won't. But it's interesting that we're more culturally sensitive than ever to the importance of "womb safety"—not only avoiding disturbances but also playing Mozart and Bach to the gravid belly. We're reminded that chemistry emerged slowly out of alchemy, and evolution theory arose out of natural theology. Theories of maternal imagination reveal a complex dialogue between folk psychology, teratology, and medical embryology.[22]

These days, we're not metaphysical about the imagination. Or at least

we lengthen the causal chain between antecedent imaginings and physical changes in the world. We no longer think the imagination sculpts different kinds of bodies, but from Freud through to the present, we do think psychological images have long-range impact on the well-being of the imaginer and his community.

Culture has always used the imagination as a tool for social cohesion and ethical norm enforcement—take another look, for example, at Christian paintings of hell. But consider that we are now living in a culture where some of the most sadistic torture movies can be downloaded by anyone with an Internet connection. With a very modest cable television package, for example, I recently watched (to my great regret) a handful of Hollywood films involving a zombie pushing a needle into a victim's eye (slowly), followed by a relentless gang rape scene, topped off with a revenge sequence in which a man is tied to a tree with his eyelids hooked open by fishing tackle and crows pluck out his eyes. Am I psychologically improved by such images or diminished by them?

The director of the splatter film *Hostel*, Eli Roth, has defended his sadistic films on what appear to be Freudian grounds. Interviewed frequently in the media, Roth argued that horror films tend to crop up more when the country is undergoing severe social stresses: the Vietnam era produced the original *Texas Chain Saw Massacre*, *Last House on the Left*, and others, while the post-9/11 and Iraq War era also corresponds with an influx of violent horror films. Political correlations aside, Roth argues that human fear and anxiety are held in check during our day-to-day functioning, but sometimes we need to exorcise these troubling emotions. Horror films allow us the opportunity to scream and release anxiety in a cathartic manner.[23] Horror films, according to Roth, have a therapeutic effect. "There are soldiers in Iraq," Roth explains, "that write me and tell me that *Hostel* is one of the most popular movies in the military."

> They love it. I wrote back and asked, "Why on earth would you watch *Hostel* after what you see in a day?" And he wrote back and said that he was out during the day with his friends and they saw somebody's face get blown off, and then they watched the movie that night with about 400 people and they were all screaming. But when they're on the battlefield, you have to be a machine. You can't react emotionally. You have to tactically respond to a situation. And these guys are going out every day seeing this horrible stuff, and

> they're not allowed to be scared. But it all gets stored up, and it's got to come out. And when they watch *Hostel*, it's basically saying, for the next 90 minutes, not only are you allowed to be scared, you're encouraged to be scared because it's okay to be terrified.[24]

Roth does not explicitly intone Freud in his explanation, but that is only because the theory of the repressed and released Id has now attained the paradigm status of common sense. But if torture porn encourages a purging of anxieties, it certainly adds new previously unimaginable images of vulnerability to the audience's experience. It remains to be seen whether or not the fears and anxieties that torture porn takes out of viewers by catharsis is superseded by the new fears it puts in.[25] Some critics of sadistic imagination, including the creator of *Buffy the Vampire Slayer*, Joss Whedon, have claimed that torture porn debases its audience—taking away something from the people who have seen it.[26] We'll come back to the wider social and psychological implications in the last chapter of this book, but for now we need to introduce some of the cognitive architecture that underlies the stories we consume.

A SECOND UNIVERSE

Salvador Dalí met Sigmund Freud only once, in 1938, but the patriarch of the unconscious had already been shaping the artist's dreams and paintings for decades. Dalí showed Freud his *Metamorphosis of Narcissus*—a nightmare of twisting and melting human flesh and musical instruments—as a demonstration of his devotion to Freud. Years before, in fact, Dalí—inspired by Freud's *Interpretation of Dreams*—experimented by placing his unfinished paintings at the foot of his bed, so that he might take the imagery into the dream world. He would then "work" upon the imagery while asleep and return from reverie with useful souvenirs and solutions. Dalí was so dedicated to exploring the fertile liminal space between consciousness and unconsciousness that he frequently took naps while holding a spoon over a metal mixing bowl, so he'd repeatedly startle awake to the clang of his drowsy spoon drop.

For many of us, surrealism is a paradigm example of what we mean by imagination. Who shows us better the meaning of imagination than the weirdest, eccentric artists? But we're actually misled about the na-

ture of imagination if our paradigm cases are artists. Scientists, too, are highly adept with the mysterious imaginative faculty, employing it in many theoretical breakthroughs. Charles Darwin, for example, could not formulate the precise mechanism of evolution until he chanced to read an unrelated economics essay by Thomas Malthus. Human population growth, according to Malthus, is checked by resource limits—adapting population numbers (by famine and disease) to the changing contours of available food, land, and so on. Chance favors the prepared mind, as Louis Pasteur noticed, and Darwin suddenly imagined Malthus's economics principle applied to all of Nature herself. In this imaginative leap, the principle of natural selection was born. This appears to be an example of *hybridizing frames*, which was discussed above in the list of improvisational techniques.

Crossing from one domain to another is a crucial feature of imaginative thinking. Einstein claimed that his mind engaged in a kind of "combinatory play" or "associative play" just before his breakthroughs. His logical analysis would follow after this synthesizing creative phase. Many mathematicians and scientists get their "aha moments" after they have relaxed their conscious pursuit of a solution. When the problem sinks down into the unconscious, it continues to have a life, as it were—a private life that consciousness is not privy too. Then, while she's brushing her teeth or crossing the street, the scientist suddenly sees her solution. Einstein famously said, "I am enough of an artist to draw freely upon my imagination. Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world."[27]

A hagiography of imaginative artists and scientists will not reveal the most important and ignored aspect of our creative faculty—namely, its centrality to our mundane as well as our magical thinking. Philosophers call this ability to think of something that doesn't exist "counterfactual" thinking. And the vast majority of our thinking is of this non-real, counterfactual variety. When you lie in bed playing a revisionist version of the argument you had with your boss—a version where you make some genius and vindicating retort—you're engaging in counterfactual thinking. When you project a series of possible outcomes before you go on a date or eat a cake or buy a house, you're engaging in counterfactual thinking. As Harvard psychiatrist Arnold H. Modell puts it, our minds

have the ability to create "a second universe"—an internal environment of possibilities that exists concurrently with the stubborn physical world.

Do other animals have this second universe? Do some children fail to develop imagination? Did early humans have it? These deep questions put the imagination at the center of the human mystery. But surprisingly there is very little philosophical writing or scientific research on the imagination, and what little that does exist treats imagination as peripheral (a sub-branch of aesthetics). Contrary to our negligent tradition, the improvising imagination should probably be the paradigm of human thinking.

Cognitive science has made great strides in the realm of computational information processing, but that stuff is not thinking. Computer programs simulate thought by channeling input data through logical syntax systems to arrive at outputs. This approach to cognition—artificial intelligence—produces great chess-playing and *Jeopardy!*-winning computers, but it doesn't help us understand the more image-based and embodied thinking of human beings. The imagination is more associational than computational—it links together ideas and images instead of deriving or inferring them. And yet the imagination is not a passive spectator of images and memories, for it also actively constructs new knowledge and new behavioral options. The representations in the mind's eye are not just information data, like neutral photos, but have a fundamental emotional or affective component—at the very least, a representation comes painted with an "approach" or "avoid" feeling (positive or negative affect). We use the representations of the second universe (the virtual world) to rehearse for, predict, and re-create the first universe (the actual natural world).

Archaeologist Steven Mithen argues that our ancestors lacked some of our powers of imagination. The cave paintings and Venus sculptures of the Upper Paleolithic (50,000–10,000 years ago) are often taken as evidence of artistic imagination—a sparking period for the cultural conflagration to come. But Mithen points out that even the simple hand ax—which was flaked repeatedly to a biface symmetrical point—required our earlier ancestors *Homo erectus* to imagine an ideal form at the end of the knapping process. Some kind of counterfactual image—a remembered ax or a mental ideal, or something, must have guided the real-time process. But while this early case of an emerging second universe (inside the

1.2. The Venus of Willendorf is a four-inch statuette, believed to be carved between 28,000–25,000 BCE. Similar Upper Paleolithic statuettes have been discovered all over Europe.

Homo head) is interesting, archaeology suggests that their imaginations were rudimentary. Once fixed upon, hand-ax industry stayed basically the same for over a million years and did not evolve into other adaptive tools like spear points, arrowheads, and stone knives. Mithen suggests that pre-sapiens humans lacked the more sophisticated imagination to innovate these useful new tools.[28] The imagination comes online slowly, in fits and starts, over the course of human evolution.

In fact, we might be engaging in some unjustified anthropomorphism (or sapiens-morphism) when we think of *Homo erectus* flint knapping his way toward some mental ideal (even remembered prototype). Our modern brains might fix an ideal image in our mind's eye and then chip our stone tool toward that teleological end, but this presupposes a very sophisticated second universe. Our ancestors more likely carried real prototype hand axes with them and knapped new stones to resemble the physical forms in front of their eyes and in their hands. The physical prototypes themselves may have slowly emerged, carried down through generations, after earlier discovery of useful, naturally occurring bi-face stones. The art of stone tool creation was probably governed more by physical copying or mimicry, rather than by mental representation or ideational design.

Our own second universe is very good at representing things that we've seen before. *Homo sapiens* remembered experiences and then replayed them and re-created them with increasing executive cognitive control and purpose. Something dramatic happens when we move beyond a remembered image to an embellished image. The famous fertility carving Venus of Willendorf (25,000–28,000 BCE), for example, has an unlikely obese body type for the time of its creation—more a work of the second universe, perhaps, than an accurate memory or perception. Presumably the artist employed imagination to expand the hips and breasts of the endomorphic bodies that he/she encountered in the real world. That kind of extrapolation and embellishment is more miraculous than it at first seems.

It's "miraculous" because it means that our head space can take in copies or representations of the outside world and then manipulate them inside the mind. Obviously, we can fit a representation of a hippo in our head, but not the hippo. We take in shape, color, sound, and so on, through perceptual equipment, but how does this get instantly stitched together into a coherent hippo (in real time), and how does it become a symbol (after the perception) for later cognitive manipulation? The Epicurean philosophers of ancient Greece were so mystified by mental representations, they formulated a charming theory that physical objects are always giving off atomic tissues or films of themselves—like the shedding of ghostly invisible skins—and these atomic films enter into our eyes and travel into the mental space. Happily, we understand perception much better these days, but our understanding of how representations form (bind together sense data), get stored, get re-accessed, and get played with is not much better than the quaint Epicurean view. Neuroscientist John R. Smythies poses the relevant question, "How do the brain mechanisms actually construct the phenomenal object?"[29] Neuroscience will certainly help us, over the next few decades, grasp some of the mechanics of our counterfactual second universe, but we're just beginning the investigation.

In the philosophical tradition, the term "representation" has a broad sense. It is an inner mental entity that has meaning via its *correspondence* with the external world or via its *coherence* within a context of other meaningful experiences (i.e., other representations, rules, schema, emotions, and so on). My representation of a "dog" stands in for real flesh-and-blood mammals out in the world. The mental method for acquiring such an inner "dog" is still much-disputed territory (from naïve realism

1.3. An imaginary hippo in a tutu. Inspired by the 1940 Disney animation film *Fantasia*.

that sees the mind as a mirror of nature to social constructivism that sees culture as the creator of our inner conceptual categories, to all points in between). My own views about representations (What are they, and how do we get them?) will emerge naturally from the coming chapters, but it is enough now to acknowledge that our second universe is populated with thoughts, beliefs, concepts, images, and so on that have some level of *intentionality*. My inner image of a dog *intends*, refers to, or is "about" some four-legged creature out in the world. But even my imaginative improvisations—Cerberus the three-headed dog or Scooby-Doo—have some intentionality too, in the sense that they refer to mental realities, possibilities, and traditions (housed both in the individual mind and the reservoir of culture).

Our inner play of representations is remarkable partly because we have significant control over the process, and our distant ancestors probably didn't. I can consider a hippo in my mind's eye by calling up a memory from past experience, but I can also imagine it purple or ten times its natural size, or even dress it in a tutu and dance it through my Disney-esque mind space. That means that I have a lot of agency in the second universe—in fact, I have almost God-like control there. But before we

evolved the ability to control the second universe, it probably had a rich life of its own and controlled us every night when we entered dream sleep. We'll return to dreams in a subsequent chapter, but for now we must acknowledge the central problem of doing "archaeology" of the human mind.

The current operating system of our minds is a bias generator, as we try to penetrate the ancestral mind (which had a different operating system). If I try, for example, to imagine what it was like to be a conscious being before language (either a *Homo erectus* man or a contemporary *Homo sapiens* baby), I run straight into the fact that my mind is already deeply structured by language. It is difficult to peek around the veil of language to see the prelinguistic operating system at work. Likewise, if I go out and try to flint knap a stone ax, I'll try to remember images I've seen, try to hold them in my mind's eye (even rotating and manipulating them), and work the stone toward that end. But this requires symbolic token/type thinking, sequential mental grammar, and executive intellectual management that almost certainly preclude our ancestors from flint knapping with the same methodology. Just as animal ethologists must avoid the tendency to project human rationality onto animals, we must be careful not to project contemporary forms of creativity (highly intellectual and culturally sophisticated) onto our earlier ancestors.

My goal in this section has been to acknowledge the rich second universe of representations that we enjoy and to admit their importance for contemporary imaginative improvisation. It's a reasonable place to start our investigation because we are more phenomenologically aware of our representations (more aware, anyway, than we are of the mind/brain mechanisms that produce them). But now we need to bracket out this rich conceptual inner world (for a few chapters at least) and try to dig underneath it to find its evolutionary predecessors. So, we will come at the improvising mind obliquely for a few chapters, before returning to the more recognizable cultural manifestations of human imagination.

PHILOSOPHICAL MISSTEPS

I recognize that philosophers isolated some extremely important aspects of the imagination, but they also turned us in the wrong direction. Aristotle, in his *De Anima*, suggested that the imagination (*phantasia*) is a middle faculty between our sense perceptions (colors, sounds, tastes,

etc.) and our mind (the realm of concepts and judgments). Like sight, the imagined form has sensual properties and shares in some aspects of our embodiment. The imagination—which Aristotle says is "that in virtue of which an image occurs in us"—provides us pictures that have particular shapes, sizes, colors, and so on.[30] But sense impressions are never really false, according to Aristotle. They are like raw data. When the drunk person perceives the walls moving, he truly perceives the walls moving. Imagination, however, joins perceptions to additional mental data and sometimes forms judgments. In this way it is more like mind (*nous*), which abstracts out particular sensual data and considers the universal defining features of a thing. Mind is a "form of forms"—able to ignore the material aspects of natural things and record and process their formal aspects. Mind can run *code* versions of experience.

Although there are many differences between Aristotle's and Immanuel Kant's philosophies, Kant seems to agree that the imagination is an unconscious synthesizing faculty that pulls together sense perceptions and binds them into coherent representations that have universal conceptual dimensions.[31] I see this fluffy brown shape moving in the field and quickly judge it to be a rabbit—a creature that fits into a formal conceptual category (of the family Leporidae, inside another category Mammalia, inside the subphylum Vertebrata, etc., or the folk-taxonomy equivalents). The imagination (an inscrutable black box) plays some role in subsuming particulars (percepts) under universals (concepts).

According to philosophers, our image-making faculty helps package our experience into manageable units that can be plugged into cognitive judgment faculties. These cognitive judgments are propositional, in the sense that they have subject/predicate attribution structure ("the rabbit is brown") and the judgments are categorial ("this brown creature is a mammal"). But a little reflection will reveal the strangeness of this model. It is extremely rare to see a moving shape in a field and suddenly turn into Linnaeus, cataloging and classifying my experience into a cognitive system. We rarely engage with the world by explicitly categorizing it, using essentialist definitions. In rarefied endeavors, like science, we try to relate our experiences to abstract models and form judgments and predictions accordingly, but most of our imaginative work is well below that erudite level.

Philosophers have "jumped the gun" and raced straight from perception to propositional conceptualization, missing the huge middle ground.

I recognize the rabbit more by automatically *associating* it with memory images, not subsuming the percepts under a formal abstract concept. I associate this brown creature to a prototype memory—a learned and stored master image of a rabbit—and this helps put the experience into an overall context of meaning. And I manage to *judge* the experience in many ways that are not like logical inferences. As soon as I recognize the rabbit, for example, I am affectively or emotionally drawn ("Oh, isn't he cute?" Or in the case of the killer rabbit in *Monty Python and the Holy Grail*, "Isn't he frightening!"). These positive and negative affective judgments are very tightly conjoined with our perceptions and slip into the psychological mix well ahead of the conceptual processing.

The missing middle ground, which philosophers have ignored, is the truly interesting territory for us because it is the realm of evolutionary degrees. Before you have a modern eye, you need a simpler optical predecessor, and before that you need a responsive light-sensitive tissue. Evolution scales up from the ground, so to speak. Evolution built a crude imaginative faculty before it refined it into a sophisticated one. The crude system (dominated by affects and perceptions) is still alive and well in the basement of our psychology. In the two chapters ahead, I will explore some of these underappreciated forms of imaginative and adaptive improvisation, namely: thinking with your body, and thinking with images.

YOU ARE AN EXPERT IMPROVISER

When I was in my twenties, I had the good fortune to play guitar as an opening act for blues legend B.B. King. This lucky break opened many doors for me, and I soon found myself playing with other legends like Otis Rush, Buddy Guy, and Bo Diddley. Whenever Bo Diddley came through Chicago, I was repeatedly hired to play guitar for him. These were hair-raising gigs, because we never talked or rehearsed beforehand, and I never knew what was coming until he walked onstage during the actual performance. The first time he hired me, I spent hours the week before the gig rehearsing and reacquainting myself with Bo's many hits. He arrived to the venue five minutes before showtime. When I first met him, as he walked onstage in front of five hundred shouting fans, I tried to tell him all the songs I had prepared. He just looked at me blankly—through his coke-bottle glasses—plugged in his guitar, and launched into a loud rhythmic riff on his trademark square guitar. He never bothered

to tell me what song we were playing, what chord changes were coming, what key we were in, or anything. But, as every blues and jazz musician knows, that's how it goes.

I was getting my improvisational education from some of the masters. But the apprenticeship was stressful. Bo Diddley, Buddy Guy, and all the great blues bandleaders never told me what was coming next, because they didn't know themselves. My job was to fumble and find the chord we were playing, which usually told me the key signature. Sometimes I could assume a certain chord progression and scale, but not always. Then I had to watch the bandleader like a hawk, for subtle cues of musical direction—this tilt of the guitar means I should solo, this slight bend of the knees means bring the dynamic volume down, this sudden jerk of the upper body means break, or stop. Once, while playing with the great but volatile Otis Rush, the band missed the cue and played one beat too many. He stopped, walked slowly over to us, as the audience looked on intensely, and said between clenched teeth, "When I tell you to stop, you muthafuckin' STOP!"

Improvising is simultaneously composing and performing, and doing it onstage in front of a large audience with an exacting and temperamental artist is high-stakes creativity. There may even be a touch of masochism in it. But it is certainly spontaneous, and the great innovators, like Buddy Guy, have found a way to maximize the jeopardy and exhilaration.

I played in the house band of Buddy Guy's music club Legends throughout the 1990s. Together with a band called Howard and the White Boys, I toured the Midwest with Buddy, as he supported his album *Damn Right, I've Got the Blues*. This led to many improvisational moments, as Buddy regularly jumped onstage to surprise us while we played. He enjoyed "cutting heads" (guitar dueling) with me, and we often engaged in spontaneous riff conversations, where he would play a two- or four-measure melody and I would try to copy it, augment it, or even best it, if possible. He taught me how to take my time and wait for the music to "come to me" rather than forcing it with too much strident effort.

Buddy is such an improvisational musician that he often starts a song and after two verses feels moved to turn in a new direction, singing a completely different song for a couple verses, until the spirit moves him to switch again. This technique is maddening for the purist, because Buddy doesn't finish what he started, but it's also exciting and unique because no two performances are ever the same. Playing with such a genius

is a huge challenge, because songs change, key signatures change, tempos change at the drop of a hat, and everyone is at the immediate behest of the artist's changing mood.

None of this imaginative improvisation works, however, unless the musicians share a language of musical tools and norms. And some of these tools (scales, chords, etc.) and norms (conventions of dynamics, breaks, progressions, etc.) are learned on the job, so to speak. They are acquired in the process of the communication itself. A more open and attentive listener acquires more innovative and nuanced moves, and increases her lexicon of expressive gestures. And of course some pre-learning and practice are also crucial for a successful and adaptive improvisational encounter.

Music aside, the deeply improvisational nature of most verbal conversations reveals the balance and need for shared tools, norms, and processes. We can see some of the hidden tools and norms more clearly when we consider the imperfect rather than perfect case of conversation. Talking with a stranger in a tongue that is not your own, for example, is deeply humbling and imperfect, but also reveals the interplay of prepared tools and real-time apprentice learning. The process is more associational than algorithmic.

I have been learning to speak Mandarin for years, and foreign languages are not one of my natural aptitudes. As any second-language learner knows, before one can really converse with a native speaker, there are many levels of intermediate proto-conversation. You learn a language in part by first memorizing some stock phrases, and these become your go-to clichés. As soon as a real-world exchange goes off script, which is quickly, the beginner is lost. But the intermediate speaker can try to get things back on track with certain improvisational "bridges" that keep dialogue rolling.

Sometimes in China, I would get into a brief conversation, and the topic would tilt toward food. In the midst of my intermediate proto-conversations, I would often fail to properly understand a question or comment, or I'd catch the tail end but not the full meaning. If I kept asking the person to repeat themselves, they would quickly give up and stop engaging in the conversation—in part because they could see we weren't getting anywhere and also because they were embarrassed for me. An alternate move, however, was more adaptive.

While still confused by a specific statement, one can reply with a state-

1.4. Any traveler who gets off the beaten path unwittingly engages his finest improvising skills, even in a gentle haggling session.

ment that is at least vaguely connected to the topic at hand—stating it as if you are answering their question or comment. In most of these cases, the other person nods and keeps going with you. You've added something in between an appropriate response and a non sequitur. It's a kind of pseudo-sequitur. It is a bridging mechanism that gets you to the next bit of conversation that both parties understand.

"Do you like Chinese food?"

"Yes, I like it very much."

"Do you enjoy dumplings?"

"No, I have not eaten yet today. I am very hungry."

"I see. Do you like tea?"

"Yes, I like green tea very much."

In music and everyday conversation we achieve startling speeds of improvisation, and the stakes can be dramatic. But a truly high-stakes form of improvisation can be found in medicine, where lives are actually hanging in the balance. Medical improv is a new form of training, in which theater improv techniques are used to train doctors, nurses, and first-

responders to communicate and troubleshoot more effectively. Workshops are cropping up all around the country, and Northwestern University Feinberg School of Medicine is a forerunner in the movement. Professors Katie Watson and Belinda Fu, at Northwestern and University of Washington, respectively, organize training sessions for health care providers and clinicians. "Improvisational theater skills have a surprising and substantial overlap with skills required of clinicians," according to Watson and Fu. "Improv is a genre of performance art grounded in principles of spontaneity, adaptability, collaboration, and skilled listening."[32]

We're all familiar with the common improv exercise of "ask for"—wherein the improviser asks for a suggested place or character persona or situation from audience members. But many other improv exercises reveal the larger social and cognitive structures of rapid problem solving. For example, an often-used exercise in improv is sometimes called "Advance and Expand." In this exercise, a group of improvisers will be spontaneously creating a scene of one sort or another, and the instructor will shout out "advance," requiring the players to focus their comments and gestures entirely on advancing the storyline of the scene. At another time, the instructor shouts out "expand" and the players must immediately explore the environment to find fresh resources or directions for the scene under construction. These discoveries can then be incorporated into advancing the storyline too. We will see in chapters 5 and 6 that cultural history and the mind itself toggle between these "advance and expand" tendencies. There are highly associational stream-of-consciousness states and more consolidated and centralized-conscious states that work together in the improvisational imagination. But more on that later.

A medical team, especially in emergency situations, needs to assess problems quickly, determine curative options, and mine the immediate environment for useful resources. Improv training can be helpful for such dramatic troubleshooting, but it also helps doctors with notorious communication challenges. When medical students in Northwestern's medical improv course were asked to name some of the common complaints about doctors, they listed: "Doesn't listen, arrogant, bad communication, makes you feel inferior, objectifying."[33] One of the cardinal rules of improv training, however, is to respond to others with the modus operandi of "yes, and . . ." rather than "No." When someone proposes an unfamiliar or strange idea, the improviser does not immediately shut it down

because it is unfamiliar or inconsistent with her assumptions, but rather explores the idea. Practicing this "yes, and . . ." communication style can help health care providers overcome some of the common complaints and also aid in proper diagnosis and treatment. " 'Improv' is not synonymous with 'comedy,' " explain Watson and Fu, "but the fundamental principles of improv (spontaneity and honesty) can naturally lead to humor. That's what makes medical improv 'serious play'—the method is fun, but the goals are serious."[34]

Like medicine, business schools have recently begun to incorporate improvisational training in their management and executive curriculum. Robert Kulhan has been improvising on stages for many years, and he also teaches improv skills at Duke University's Fuqua School of Business, in North Carolina. "Improvisation," Kulhan explains, "isn't about comedy, it's about reacting—being focused and present in the moment at a very high level."[35]

Lakshmi Balachandra, at MIT Sloan School of Management, teaches Improvisational Leadership and also lectures for advanced negotiation students at Harvard Business School. Before working in venture capital and finance, Balachandra was an improvisational comic and found those skills to be crucial in her business career. Improvisation, according to Balachandra, helps people think on their feet and react very quickly to unexpected changes that are impossible to plan for. "It applies to leadership and it applies to negotiation, where you never have control over what happens. Negotiation is a dynamic process—you have to be able to think on your feet and adapt," Balachandra explains. In business training, the improvisational approach helps leaders suspend their judgment, increasing the likelihood and effectiveness of creative brainstorming. This is the same modus operandi of "yes, and . . ."

Music, medicine, business, and everyday conversation are just a few of the diverse domains that reveal a common underlying cognitive structure. You, dear reader, should recognize yourself in some of these activities. You may not be a jazz musician or a field surgeon, but you are an expert improviser in some domain—conversation, cooking, parallel parking, parenting, or small business management. In the coming chapters, we will explore the underlying cognitive, emotional, and social structure of your improvisational expertise.