

Strange Trajectory: A Story Of Phineas Gage

Waiving the claims of personal and private affection, with a magnanimity more than praiseworthy, the mother and friends, at my request have cheerfully placed this skull (which I now show you) in my hands, for the benefit of science. It is regretted that no autopsy could have been had, so that the precise condition of the encephalon at the time of his death might have been known. ¹

September 13, 1848. A morning like any other, as far as Phineas Gage was concerned. Vermont sun still warm, but a hint of fall in the air. The quiet, steady rhythm. The grunts of men laboring, the sounds of hammer hitting spike, of heavy rails carried and dropped on rocky ground. The sporadic, idle conversation. Phineas at 25, strong and healthy, a construction foreman for the Rutland and Burlington Railroad. A man with hopes of advancement.

Phineas had no way of knowing that this day was special, that he was about to make history. That his "case" would be the subject of scientific discussion more than a hundred years after his death. That his brain would one day be electronically reconstructed on a computer screen, scrutinized from every possible angle. Phineas was simply doing his job on a sunny Vermont day, with the air just beginning to turn.

¹ John M. Harlow, M.D., in a presentation to the Massachusetts Medical Society, June 3, 1868

Phineas worked slowly that morning. Methodically. To lay rail across Vermont, it was necessary to level the terrain by controlled blasting. Among other tasks, Phineas was in charge of the detonations. The procedure ingrained in him. Drill holes in the granite. Fill the holes with blasting powder. Plant a fuse, cover with sand and tamp with the iron to compress it all. Trigger an explosion into the rock.

The tamping rod measured three and a half feet long, an inch and a quarter in diameter. Twenty-two pounds, seven ounces. A single long cut of iron, straight and worn smooth from handling. Fine-pointed at one end, rounded at the other. Within an hour of beginning the morning's work, it would create a sweat in Phineas' hands, which were callused all along the pads of the palms. By noon each day, it would feel like an extension of his arms, the weight forgotten, absorbed into the rhythm of the procedure, which he would repeat ten, twelve, twenty times a day. To clear rock. To lay track.

Phineas loved the work. The fact that his labor was producing something worthwhile, connecting Rutland and Burlington to the great cities of the northeast. With every blast, every stroke of his tamping iron, Phineas felt the future moving northward through Vermont, felt part of something larger than himself.

Behind him, his crew loaded rock upon a platform car with a derrick. Phineas prepared a blast while the men cleared the last one behind and beneath him.

"The preacher said it was a sin. It's true. He said the child is sinful." Henry's voice rose with the effort of landing heavy stone into the bucket.

Phineas scratched at a hole in the rock, making space to lay a fuse. When all this was finished, when the railroad was built, he would move to Burlington. Run the repair yard. Find a woman who understood his ambition.

Beneath the granite shelf on which Phineas stood, Thomas scratched his head. "But the child's an idiot. It's not a choice he makes."

"Did you fellows know Thomas was a philosopher?"

Laughter.

Thomas and Henry loaded stone, the bucket at the end of a long rope. They signaled to Arthur, who pulled on the end of the rope with Bart to hoist the stone. Stack it in an ox cart and haul it away.

"Five years old and can't speak to be understood. It's God's punishment. That's what the preacher said, and that's what I believe."

ANGLE: Based on measurements of the iron rod and on the recorded descriptions of the accident, we determined the range of likely trajectories. We simulated those trajectories in three-dimensional space. We modeled the rod's trajectory as a straight line connecting the center of the entry hole at orbital level to the center of the exit hole. This line was then carried downward to the level of the mandibular ramus. The skull anatomy allowed us to consider entry points within a 1.5 cm radius. The trajectory connecting each of the entry and exit points was tested at multiple anatomical levels. Acceptable trajectories were those which, at each level, did not violate certain conditions.

Behind Phineas, behind his crew, two flatcars pulled by dust-colored horses moved up on the last finished rails. There the ties went down, five to a twenty-eight-foot length of rail.

"Heave!"

Iron men, five to a rail on each side of the track, pulled on command, hefted the six-hundred pound iron forward and, at the word "Down!", dropped it in place and lined it to the gauge.

"What does Sarah think?" Thomas wiped sweat from his brow, leaving a residue of granite dust.

The little car was already moving forward while clampers and spikers fastened down the rail.

"She thinks he's her son." Henry leaned against the platform car, legs crossed in dusty black work pants.

Phineas tamping. Smooth, even strokes. Each stroke connecting him to the future, to the new nation that will emerge.

Thomas, hands on hips, squinting into sun. "But what does she *say*?"

Closer by. Muscles moving rock.

"She says he's her son."

The clang of hammer against spike. The lingering smell of sulfur.

Thomas adjusted his cap. "What would you say?"

Phineas poured sand.

"Well?"

"Come on," said Henry, loading rock. "We're falling behind."

Thomas stood his ground. "What would you say?" Nothing. "He barks. Growls. Like an animal," Thomas says. Behind them, the grunts of men loading rail onto a flatcar. "I'm just saying. The mouth speaks the expression of the soul."

Phineas shook his head. "The things you all find to talk about."

"Well," said Thomas. "What do you think, Phineas?"

"I'll not speculate on His ways. It's blasphemy."

Henry's hand lingered on a chunk of granite. "I don't know what's God's punishment," he said. "I know about taking care of your own. Right, Phineas?"

Thomas laughed. "Don't ask him about family. He's busy building the great railroad. Can't remember who his family is. Where they live."

"Enough," said Phineas. He drew a match from a leather pouch around his waist. "Take cover."

ANGLE: Only seven trajectories satisfied all conditions. Two of those seven were rejected as anatomically improbable because they would not have been compatible with

survival (the resulting massive infection would not have been controllable in the pre-antibiotic era). When checked in our collection of normal brains, one of the remaining five trajectories spared language and motor functions but fit the hole in the skull, and was thus chosen as the most likely trajectory.

Phineas wasn't dreaming about the future. He wasn't dulled by the effects of whiskey. It was just a moment, something he couldn't have identified even if it had occurred to him. Maybe a sound from one of the other crews, maybe as simple as a cloud crossing the sun, a passing shadow to take Phineas' eye momentarily away, to make him lose his rhythm, his sense of timing, to take his eye off the hole where sand didn't quite guard the powder and the fuse, to prepare for the explosion.

The rod shot out of the hole. A three-and-a-half foot long bullet. A spike into the brain of Phineas Gage. Into his face, just under his left cheek. Up behind his left eye. Through face, brain, skull, then out into sky. Picture the rod emerging from the skull of Phineas Gage, sailing through Vermont air. The tamping rod landed nearly twenty yards away. Phineas landed on his tailbone. Momentarily stunned. (That's how his doctor, John Harlow, later described it in a presentation for the Harvard Medical Society. "Gage was momentarily stunned.")

Gage said nothing. He held a hand to his face. His men had dived for cover, and raised themselves up fully expecting to see their foreman dead. Phineas tried to get to his feet, and fell back onto the dirt. Shattered rock and sand surrounded him. By now eight or ten men formed a circle around him. He was aware of silence despite a horrible ringing in his ears. A breeze stirred the air. A warm flow of blood from somewhere.

Gage uttered a nervous laugh. "Think I'll need some help getting up."

Henry put a hand under Phineas' shoulder and pulled him up. Blood flowed to the ground. Washed Henry's hands. No one wanted to express what they were thinking. Thomas, though, was the most surprised, who had caught a glimpse before ducking, had

seen the start of the explosion. His mind's eye had traced the arc. And Gage's movement, the very fact of his being alive, made Thomas doubt what his eyes had seen. Couldn't have gone through his *skull*. Emerged from his head and shot into September sky.

"We'll need a doctor," someone said.

Someone else asked, "Can you walk?"

Gage staggered a little. Hands moved under him for support. His head felt dizzy. The ground shifted under him. He vomited blood. His legs wobbled like those of a child and he could feel an ache coming from his face. But he concentrated on walking, on the help of the men around him. Blood poured from his head. A river down his back. Down his throat into his stomach. The men carried him in their arms to the road, to the ox cart, a bed strewn with shards of stone, splinters of rough wood, and he rode the three-quarters of a mile to Leicester Junction. They got him to his hotel, to his upstairs room, and sent for a doctor.

ANGLE: There was no damage outside of the frontal lobes. The white matter core was more extensively damaged in the left hemisphere than in the right. Thus, Gage fits a neuroanatomical pattern that we have identified to date in 16 patients within a group of 28 individuals with frontal damage. Their ability to make rational decisions in personal and social matters is invariably compromised and so is their processing of emotion.

The 13th, 7¹/₂ o'clock, P.M. The small pieces of bone having been taken away, a portion of the brain, an ounce or more, which protruded, was removed, the larger pieces of bone replaced, the edges of the soft parts approximated as nearly as possible, and over all a wet compress, night cap and roller.

Fragments of memory appeared. Pain seared his head. Rock exploded behind closed eyelids. He ducked without moving. Couldn't tell if he was waking or sleeping.

If his room was dark or light. Vomited blood. Opened his eyes. A man in the room. A doctor.

Phineas pointed to the hole in his cheek. "The iron entered there and passed through my head," he said.

The doctor sat on a stool, a long distance away. The room looked different, larger, its contours strange. Swollen.

"I hope I'm not much hurt," said Phineas.

The edges of the scalp were everted and the frontal bone extensively fractured, leaving an irregular oblong opening in the skull of two by three and one-half inches. The face, hands and arms were deeply burned.

Blood. Pulse 60, soft and regular.

The doctor, John Harlow, examined and dressed the wounds, laying strips of wet cloth, replacing bits of skin that could be refolded. He worked silently. He couldn't believe Phineas was alive. The doctor was young, an avid reader, a follower of medical developments. He'd seen nothing like this. Who had? As he worked, his amazement grew. Blood everywhere. Phineas sat, composed, talking. The doctor didn't know what to say, so he said nothing.

The globe of the left eye was protruded from its orbit by one-half its diameter, and the left side of the face was more prominent than the right side. The pulsations of the brain were distinctly seen and felt.

The hands and arms were dressed, the head elevated, the wound in the cheek left open. Two attendants watched Phineas, to keep him in that position. He slept a little.

At ten o'clock, Dr. Harlow returned. The dressings were saturated with blood. The hemorrhaging had slowed. Pulse 65.

"I don't wish to see the fellows just now," Phineas said. "I'll be back at work in a few days. See them then."

Dr. Harlow removed the stained dressings. Washed the wounds. Passed the index finger of his right hand into the opening in the brain. Checked for foreign bodies. Put on a new compress. Work carefully. This is a case that could make a career.

Phineas saw two Dr. Harlows, or not quite two. Harlow as Siamese twins. Couldn't pull them together in his vision. Couldn't separate them.

"We've done what we can," the doctor said, his first words to Phineas. "Try to rest."

Sept. 14, 7 am. Has slept some during the night. Appears to be in pain. Tumefaction of face considerable, and increasing.

"How did you rest?"

Phineas opened his mouth. No words came. He heard his doctor as if from a great distance, as if through water. He saw shapes. The effort to concentrate too great.

Later. Eyes open? Two new faces in the room. "Mother? Uncle?"

"Yes, Phineas." Harlow's voice. But where was he? "They've come to visit."

"My pants, please." Faces indistinct. Hands fidgeting.

Harlow's voice. "I don't think you..."

"MY PANTS!"

Dr. Harlow handed Phineas the pants.

"Why did you let them in? I don't wish to see anyone." A wave of nausea passed through him. A distant sense of shame. Because he had walked out, he couldn't need them. Couldn't allow it.

The touch of his mother's hand in his. His withdrawing. "You'll come home soon, for a visit. I'll take care of you."

Bleeding into mouth continues.

Phineas hearing the blast. Smelling sulfur. The rhythm of his days moving through his arms. The steady tamping motion. "Who is the foreman in the pit now? Who are they using?"

Sept. 15. Decidedly delirious. A metallic probe passed into the opening at the top of the head, down until it reached the base of the skull, without resistance or pain. Brain not sensitive.

ANGLE: The case of Phineas Gage has fascinated researchers for more than 100 years. For decades, it was an enigma presented to neurology students as a freak story. In this century, as new cases of damage to frontal cortices were delineated, and as frontal lobe function remained [arguably] the least understood aspect of the human brain, Gage gradually acquired landmark status. Only recently, through the emergence of sophisticated brain-imaging technology, have we been able to fully explore this case.

16th. An abundant foetid, sanious discharge from the head with particles of brain matter intermingled, finding its way out from the opening in the top of the head, and also from the one in the base of the skull into the mouth.

Three times a day, Dr. Harlow dressed the head. Ice water was continually kept on the head and face. Attendants carefully cleaned off discharge, externally. Washed the mouth and fauces as often as necessary, with water and disinfecting solutions. The opening in the top of the head covered with oiled silk underneath wet compresses. Phineas stirred, thrashed in bed. Threw his hands and feet about. Head very hot. "I shall not live long this way," he said.

Sept. 23. At this date, ten days after the injury, vision of the left eye, though quite indistinct before, was totally lost. The scalp was reshaven and the edges of the wound brought into apposition as nearly as possible. The discharge less in quantity. Up to this time it had not occurred to me that it was possible for Gage to recover.

Dr. Harlow wadded up saturated bandaging, looked at his patient, prone upon the bed. "There," he said.

Phineas had difficulty raising his head from the pillow. Heard a voice saying, "God's punishment." Sat up. To Dr. Harlow: "What?"

"I didn't say anything."

Outside, steel gray sky. In the distance, an explosion. Granite fragments sailing through autumn air. Rail moving north.

Phineas rolled onto his side, pushed himself upright. Dr. Harlow wiped residue from the table with a towel. Arranged instruments in his bag. It was hard for him to watch Phineas.

"How soon do you think I'll be ready to go back?"

The doctor held a towel in his left hand. Rubbed his fingers back and forth, wiping a probe. Outside, a carriage rattled along the street.

"How much longer?"

The instrument dropped into the bag with a sharp click. "Maybe you should think about a change." The towel draped neatly over the back of a chair. "Something less demanding, physically."

Dizziness. Periodically, Phineas was aware that the ringing in his ears had never fully stopped. "No." Looked at Harlow through his good eye. "Work defines a man." The room shifted. "What would you do if you couldn't see patients?"

Explosion. In his head? Phineas on his knees. A voice. Henry's? *The child is sinful.*

Dr. Harlow moved to him, lips pursed in marginally concealed distaste. Reached down.

Phineas slapped at the hand offered to him. "NO," he said. "I don't need your help." The feel of the iron through his arms.

The hand remained. Sunlight golden on a chair beside him. Dizzy. He took the hand, pulled himself up along the doctor's arm, held himself upright by gripping Dr. Harlow's biceps. Got his balance. Their eyes met for a moment, inches apart, and Phineas found himself using his arms, exerting force, upsetting the doctor's balance.

Harlow released his grip, pulled away. "I'll not wrestle with you."

Phineas outside himself, watching. "See that you don't."

Says he feels comfortable. Appears demented, or in a state of mental lethargy.

"What day is today?"

"Tuesday."

"What time?"

"Morning. Late morning."

Describe the house you grew up in. Count to fifty. Recite the names of the states.

Phineas dutifully responding, trying to focus on the world outside his window.

Discharge from the openings profuse and foetid. Erysipelatous blush on skin of left side of face and head.

Occasional sounds, the slow grind of wagon wheels on road, the voices of people in the streets. Three strokes to the spike. Ten spikes to a rail. Ahead of it all, making it possible for rail to move north.

"Henry and Thomas visited. Yesterday?"

"Yes." Dr. Harlow on his stool, across the room. "Was it good to see them?"

Outside the windows, the cry of a child.

Phineas lied.

"Yes."

Not a lie, maybe. But a look in the faces of the men he worked with. Something in their eyes when they saw him. What it was to be condemned. The thought formed tentatively in Phineas' brain, but there was too much in the way for him to get at it: pain, dizziness, the confines of his room his world, the impossibility of describing how it felt to be Phineas with a hole in his head. Whiting. Salisbury. Cornwall. Towns to be connected.

Harlow writing on a sheet of paper.

"What are you writing?"

"Your case is unusual. I want to keep a record."

Today he appears stronger and more rational than before; calls for food.

ANGLE: Because he survived the momentous injury and his subsequent behavior had been traced, the case held clues to the exploration and mapping of the frontal cortices. It occurred to us that image processing techniques could be used to test this idea by going back in time, reconstituting the accident, and determining the probable placement of his lesion. Our own interest in the case grew out of the idea that Gage exemplified a particular type of cognitive and behavioral defect caused by damage to ventral and medial sectors of prefrontal cortex.

The improvement, however, was short lived. In the night following, he became stupid, did not speak unless aroused, and then only with difficulty; the integuments between the lower edge of the fracture in frontal bone and left nasal protuberance, swollen, hot and red. Failing strength.

What did I do? he wondered. Catalogued past behavior. Found nothing worthy of condemnation.

A picture in Phineas' brain. Rod shooting through skull, into sky. Phineas on the ground, seated, bleeding, looking, marveling. Phineas reaching around him, unable to see for all the blood, feeling around him for whatever he may have lost, trying to locate pieces.

During the three succeeding days the coma deepened. The globe of the left eye became more protuberant, with fungus pushing out rapidly from the internal canthus. Also large fungi pushing up rapidly from the wounded brain, and coming out the opening in the top of the head.

Explosions of light and color and pain, pain so deep it was beautiful. Violet. Cyan. A picture: Phineas, rod in hand, face enraged, swinging at stone, at ox cart, at Harlow, at anyone who is healthy, who does not have a hole in his head.

Pulse 84. Will not take nourishment unless strongly urged. Calls for nothing. Surface and extremities incline to be cool. Friends and attendants are in hourly expectancy of his death, have coffin and clothes in readiness.

No pictures. Only thoughts. That one could feel one's approaching death, one's fading life. That his mother had taught him, as a boy, that emotions reside in the kidney, that doubt resides in the lungs. Thoughts came slowly, in single file, like mourners. What about the soul? Where does the soul reside?

With a pair of curved scissors I cut off the fungi which were sprouting out from the top of the brain and filling the opening, and made free application of caustic to them. With a scalpel I laid open the integuments, between the opening and the roots of the nose, and immediately there were discharged eight ounces of ill-conditioned pus, with blood, and excessively foetid. Tumefaction of left side of face increased. Globe of left eye very prominent.

The railroad moved toward Cornwall. The laying of track. The fastening of ties. Three strokes to a spike, ten spikes to a rail. Four hundred rails to a mile. Sound carried into sky. Miles ahead, surveying parties: a chief engineer, assistant, rodmen, flagmen and chainmen, axemen and teamsters. Henry had become foreman, until Phineas returned. Phineas had become a superstition. A presence as they went about their work. A fear in the back of their minds. They received daily reports of his progress. It was a way of measuring time, like the moving north of steel rail.

Sept. 28 to Oct. 6. Discharge from the openings very profuse and foetid. Pulse ranging from 80 to 96. Speaks only when spoken to. Swallows well, and takes considerable nourishment, with brandy and milk. Says he has no pain.

ANGLE: Dr. Harlow's two papers argued that the case had much to tell about human brain function. This was a period when neurologists had begun to assert that the brain has regions specialized for language movement and perception. Dr. Harlow and [a few] others of his time felt there might also be a region specialized for rational behavior. Lacking proof of exactly where in the brain the lesion was located, however, he could not convince his opponents. His arguments were dismissed as outrageous. These things, it was argued, were the province of religion.

October 6th. Twenty-three days after the injury. General appearance somewhat improved. Pulse 90, and regular. More wakeful. Swelling of left side of face abating. Openings discharging laudable pus profusely.

Dr. Harlow on his stool. Sunlight and sound through the window. Phineas raised his head.

"How do you feel?"

How to say. Pain the orange of marigolds. The blue of full moon sky.

"Better."

"Do you remember?"

"I was injured on September 13th. The tamping iron entered here." Phineas pointing to the hole in his cheek. "I struck with the iron. The wrong spot. Could I have my pants?"

Harlow shifts on his stool. "Your condition won't allow"

Oct. 15th – thirty-second day – Progressing favorably. Fungi disappearing: discharging laudable pus from openings. Takes more food, sleeps well, and says he shall soon go home to visit.

Dr. Harlow would change the bandages twice a day, and check for healing. Thirty-nine days to form a layer of rubbery tissue across much of the area, to shrink the hole to half its original size. Every morning and every evening new bandages. New conversations. *When were you born? Describe the house you grew up in.*

"I'd like to get back to work."

"Patience. You're not even ready to go for a walk yet."

Explosions of light and sound inside Phineas' head. Some days once, or twice. Some days an unending pyrotechnic display.

Harlow cleaning instruments. Wiping counters. Fingers always rubbing. "Recovery will take a long time. Adjustment to new circumstances." But Phineas suspected something else. Something darker. A recurring dream, his fingers reaching, his mind convinced. What was lost.

Harlow rubbing. "I have to be away for a few days."

"It's okay. I'm going to visit the rail head."

"You can't"

"I CAN" Phineas surprised himself with the volume. The doctor lowered his eyes.

"You're not ready."

"I will NOT be kept in here." Anger drained him. Slapped his fist on the mattress. "Damn!"

"You've got to avoid exposure. You're not to go out."

"YOU'RE not to give me orders." Brilliant colors. Purples and reds, several shades of yellow, exploded behind Phineas' eyes. The pain beautiful in the way of something that demands your full attention. Phineas sat on the bed. The sound of laughter outside. The realization that an iron rod blasted through his brain and made a hole in his skull. The fear that he was, in some essential way, no longer himself. That something of who he was had leaked out of the hole in his head and left him lacking. Red, yellow star bursts. The sound of iron. Phineas swiped at a chair, with his arm. The chair falling. Phineas losing his balance.

Dr. Harlow moved to him, hand reaching down again.

Phineas was learning that explosions could be like music. Each its own symphony of color. Intricate. Elaborate. *Arpeggio* in browns and greens. His arm began to lash out, but he stopped it, grasped the doctor's hand, allowed himself to be pulled up. Dr. Harlow moved to withdraw his hand. Phineas held on. Squeezing. Exerting force.

The doctor jerked his hand away. Flexed the fingers.

Phineas' smile held no warmth.

Oct. 20th. Improving in every respect. Gets out of and into bed with but little assistance; eats and sleeps well. The fungi have disappeared. The opening in the top of the head is closing up rapidly, with a firm membranous tissue.

Faces. Thomas. Henry.

Phineas sat up. Room wobbled. Faces elongated, returned to shape. Heads nodded.

"Phineas." "How you feeling?"

He shrugged. What to say. "Glad you came."

Shuffling feet. The look in their eyes. "Hard to get away. You know."

"We tried to come sooner. You weren't so well for a time there."

"It's okay."

"You're looking good, Phineas." Their eyes betrayed them. Thomas, especially, who could not lie well. Phineas had seen the look – where – in the faces of men who confront death.

"I'm eager to get back."

"Sure, Phineas, but take it slow." "Listen to your doctor."

"To HELL with him" Phineas wiped a hand across his mouth, where spittle had emerged. "To hell with him."

"Even so, Phineas –"

"Are you past Leicester?"

A smile between them. "Up past Cornwall." Henry: "I'm very proud of my men – the men."

Purple. Burgundy. Black.

"We should go." "You need to rest." "We'll come soon, eh?"

Mumbling. "The hell you will."

Yellow. The yellow of spring sunrise.

ANGLE: We began by having one of us photograph Gage's skull, inside and out. The next step was to obtain a skull X-ray as well as a set of precise measurements relative to bone landmarks. Using these detailed photographs and a brain-imaging technique called positron emission tomography, we were able to reconstruct his three-

dimensional brain and the focal point of his injuries on a computer. Once the likely trajectory was determined, we could look at affected brain areas and compare to contemporary studies.

Nov. 8th. Fifty-sixth day. Sits up most of the time during the day. Appetite good, though he is not allowed a full diet. Pulse 65. Sleeps well, and says he has not any pain in his head.

Walking. Dizziness. The need to concentrate to keep the ground from moving under him. The smell of earth, of horses and food and life. Leicester Junction, thriving in the railroad's wake, no longer the base camp, the work now more than two miles north, still the town had harnessed the future. Phineas out for a stroll. Eyes on him. Tentative voices.

"Hello, Phineas."

"Good to see you about."

How strangers could know him. How he could shrink inside himself. The look in eyes that won't meet his. In eyes that will.

"You shouldn't have gone out." The room above the tavern. Near sunset. "You don't have the strength."

Sunlight spilled through the window. The pain purple-pink. Phineas focused the light in his eye on his doctor. "Do you think it's possible that something escaped?"

The room's walls an eggshell color. The doctor's hands hovered around Phineas' skull.

"Escaped?" Deft fingers removed bandages. Probed. "There was some tissue loss. Minor. Ultimately insignificant." As the doctor spoke these words, he wondered. Wondered about a rod moving through a brain. About the part of the brain the rod passed

through. Wondered about Phineas' erratic behavior. About the man his friends described, careful, cautious, steady.

"Was anything else found on the ground? Near the rod?" What does the soul look like, shattered, in the dust.

Dr. Harlow paused, looked at his patient.

"Pieces of me?"

A chill ran along the doctor's arm. Years later, after Phineas' death, Dr. Harlow would think about that moment, in that room, would begin to grasp the real meaning of Phineas' question as he wrote an article speculating on the possibility that there is a locatable moral center in the brain. But what could be gained by planting doubt.

Dr. Harlow chuckled. "Don't worry. You're all here. The road to recovery."

Nov. 18th. Is walking about room again, and appears to be in a way of recovering, if he can be controlled. Has recently had several pieces of bone pass into the fauces, which he expelled from the mouth.

First frost. Fire in the hearth. Inside Phineas' head, a particularly colorful day.

Dr. Harlow on his stool. "Have you thought about it?"

Vermilion. "Hmm?"

"What you're going to do. An office job."

"I couldn't." Butterscotch. "It's being out there, being part of it." The sound of rail dropping to the ground. The thought of inexorable movement forward.

"You've had severe trauma."

Moisture beaded on the outside of the windows. Veins of frost dissolved.

Dr. Harlow taking notes.

Jade. The impulse to hurt. "It would be so easy."

Dr. Harlow, pen in hand, looking up. "What?"

"An accident." A log popped in the fire. "Waiting for a moment with Henry on a ledge below me, the others out of the way. Easy to say that Henry never heard the 'Stand clear,' that I never saw him." Black. Henry falling. Rock raining down on him. Phineas listened to the words coming out of his mouth. Inside, a scream. A lament.

Dr. Harlow's face was ashen. He didn't know how to respond. How to characterize this behavior. Papers sat idly on his lap.

Phineas gestured at them, a smile, a wince dancing at the edges of his mouth. "Might I see your notes?"

The doctor's eyes refocused on the room. On the patient. "Nothing very interesting," he said. "And the handwriting's impossible."

Dream state. Thrashing on his bed. He saw his deathbed, years hence. Convulsions. Phineas had returned to his mother's house, weary from travel. The colors were no longer beautiful. No longer mesmerizing, though he continued to marvel that so many gradations were possible. Shivering. A glimpse of a boat, a cold stinking boat, carrying him somewhere. He had not planned it this way. Could not keep a job. His mother's words in a letter: "you always find *something* that doesn't suit you." Can't help it. He would wander the world. He would die in his mother's house. He had not planned it this way. Was not this person his words revealed. The colors. The cold. Unfamiliar places. The look in eyes that won't meet his. In eyes that will.

Jan. 1, 1849. The opening in the top of the head entirely closed, and the brain shut out from view, though every pulsation could be distinctly seen and felt. General appearance good; stands erect, with his head inclined slightly towards the right side. The left side of the face is wider than the right side, the left molar bone being more prominent than its fellow. Applied for his situation as foreman, but is undecided whether to work or travel.

ANGLE: Unassisted by the tools of experimental neuropsychology available today, John Harlow came to equate Gage's cognitive and behavioral changes with a presumed area of focal damage in the frontal region. Other cases of neurological damage at that time were confirming the brain's foundation for language, motor function, and perception. Gage's case indicated that perhaps there were structures in the human brain dedicated to the planning and execution of personally and socially suitable behavior, to the aspect of reasoning known as rationality.

I lost all trace of him, and had well nigh abandoned all expectation of ever hearing from him again. As good fortune would have it, however, in July 1866, I was able to learn the address of his mother. From her I learned that Gage was dead.

In August 1852, nearly four years after his injury, he had turned his back upon New England, never to return. He conceived a great fondness for pets and souvenirs, only exceeded by his attachment for his tamping iron, which was his constant companion during the remainder of his life [and which was, in fact, buried with him]. He engaged with a man going to Chile to establish a line of coaches. He moved to San Francisco. Spent time in New York, at Barnum's. Worked for a farmer in Santa Clara. In February 1861, while sitting at dinner, he fell in a fit, and soon after had two or three fits in succession, which led to his death at age 37.

I desire to gratefully express my obligations, and those of the profession, to D.D. Shattuck, Esq., brother-in-law of the deceased; to Dr. Coon, Mayor of San Francisco, and to Dr. J.D.B. Stillman, for their kind cooperation in executing my plans for obtaining the head and tamping iron, and for their fidelity in personally superintending the opening of the grave and forwarding what we so much desired to see.²

² John M. Harlow, M.D., in a presentation before the Massachusetts Medical Society, June 3, 1868

Italicized portions here are paraphrased and/or excerpted from Dr. Harlow's journal or his June 1868 presentation to the Mass. Medical Society. (Pub. Mass. Medical Society, 2, 327 [1868])