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Article 1.
The Washington Post

Shimon Peres, Israel's dreamer and doer

David Ignatius

June 26 -- At a farewell dinner for Israeli President Shimon Peres in Washington on Wednesday night, several of the American guests appeared to approach him with tears in their eyes. This emotional display was a sign

of Peres's personal impact on the U.S.-Israel relationship and the way his departure marks the passing of an era.

Peres, at 90, is the last iconic figure of Israel's founding generation. All the powerful elements of Israel's creation are part of his life story: He emigrated from Poland in 1934; his family members who remained behind were killed during the Holocaust, many burned alive in their local synagogue. He worked on a kibbutz as a dairy farmer and shepherd, and at the age of 24 he became a personal aide to Israel's founding leader, David Ben-Gurion.

"Little did he know it at the time, but milking cows and herding sheep prepared him well for a long career in Israeli politics," Israeli Ambassador Ron Dermer told the gathering at the Israeli Embassy. Dermer cited the astonishing statistic that Peres has been a public servant in Israel for nearly 67 years, including two stints as prime minister.

What has marked Peres throughout his career has been a liberal optimism about Israel and its place in the world. The years of war and terrorism made many Israelis darkly cynical about their state's survival and the measures necessary to preserve it. A cult of toughness developed among Israel's political elite, which has taken full flower in Prime Minister Benjamin Netanyahu and his coalition partners. But Peres remained outside the tough-guy circle. He spoke openly, perpetually, about his yearning for peace.

Peres's gentle demeanor contrasted with the implacable, bulldozer style of other members of the founding generation, from Yitzhak Rabin and Golda Meir to Ariel Sharon and Menachem Begin. Peres sometimes seemed the bridesmaid at the Israeli political wedding, never quite achieving the status of some of his contemporaries. But he outlasted them all, and as Americans began to wonder during the Netanyahu years whether Israel was really committed to a two-state solution to the Palestinian problem, Peres was a reassuring affirmation.

The optimistic side of Peres's character was captured by Susan Rice, the U.S. national security adviser, in moving remarks. After saying that Peres had often reached out personally when she had a "rough patch" the past few years, she quoted her favorite Peres-ism: "There are no hopeless situations, only hopeless people." In another man, this sunny sentiment might seem soft. Not so with Peres. His was an earned optimism.

Peres spoke after the laudatory tributes. Listening to him these days is like hearing a favorite uncle or grandfather. The narrative wasn't a speech so much as a musing. But his essential point was both clear and contrarian: The United States' strength in the world is its values, not its military power. It remains strong because it is a nation characterized by "giving, not taking."

The United States didn't have to befriend the small, embattled country of Israel, but it chose to do so because of its generosity, Peres said. He talked, in a veiled way, about his farewell with President Obama that day. Peres's message, as best I understood, was that Obama should be faithful to who he is and not try to conform to demands about what he ought to be. Perhaps that's the kind of advice that can be dispensed only by the world's oldest living president.

The guests Wednesday night were testimony to the political power of the U.S.- Israeli relationship. There were several dozen members of Congress, plus Supreme Court justices, various Cabinet members and political commentators. It was a bipartisan group, which was a reminder that, however strained the relationship between Obama and Netanyahu, a core element in the relationship transcends parties and administrations.

"Peres is that rare leader who is both a dreamer and a doer — talking about the future and getting things done," said Dermer. It was very much in Peres's style that he would strike up a personal friendship with Pope Francis and show up at the Vatican this month for a meeting with the pontiff and Palestinian President Mahmoud Abbas. Dermer joked that he was the only Israeli president who might be a candidate for sainthood.

Peres's successor as president will be Reuven Rivlin, a respected right-wing politician who opposes creation of a Palestinian state — the cause Peres championed. However well Rivlin performs, it's unlikely Americans will approach him at the end of his career wiping away tears.

Article 2.

WSJ

Obama's Foreign-Policy Failures Go Far Beyond Iraq

George Melloan

June 26, 2014 -- 'What would America fight for?" asked a cover story last month in the Economist magazine. Coming from a British publication, the headline has a tone of "let's you and him fight." But its main flaw is that it greatly oversimplifies the question of how the U.S. can recover from its willful failure to exert a positive influence over world events. That failure is very much on display as Iraq disintegrates and Russia revives the "salami tactics" of 1930s aggressors, slicing off parts of Ukraine. Both disasters could have been avoided through the exercise of more farsighted and muscular American diplomacy. A show of greater capability to manage "domestic" policy would have aided this effort. The U.S. is still militarily powerful and has a world-wide apparatus of trained professionals executing its policies, overt and covert. It has an influential civil society and a host of nongovernmental organizations with influence throughout the planet, not always but mostly for the better. It has a preponderance of multinational corporations. Although confidence in America has waned significantly, it is still looked to for leadership in thwarting the designs of thugs like Russia's Vladimir Putin, Syria's Bashar Assad and Iran's Ayatollah Khamenei.

Yet President Obama has followed a deliberate policy of disengagement from the world's quarrels. He failed to bluff Assad with his "red line" threat and then turned the Syrian bloodbath over to Mr. Putin, showing a weakness that no doubt emboldened the Russian president to launch his aggression against Ukraine. The errant Iraqi Prime Minister Nouri al-Maliki, beset by a Sunni-al Qaeda insurgency, has been told, in effect, to seek succor from his Shiite co-religionists in Iran. Meanwhile, Secretary of State John Kerry amazingly urges America's only real friends in the area, the Iraqi Kurds, not to abandon the ill-mannered Mr. Maliki in favor of greater independence and expanded commerce (mainly oil) with our NATO ally, Turkey. Mr. Obama cites opinion polls purportedly showing that Americans are "war weary." Probably what the polls really reflect is something else entirely, dismay at the wasted blood and treasure that resulted from Mr. Obama's unilateral declaration of defeat in Iraq and Afghanistan. Instead of whining about "war weariness," an American president should understand his historical role. The U.S. can't just withdraw from the responsibilities that have derived from its enormous

success in making itself the look-to nation for peoples aspiring to safer, freer and more prosperous lives. The costs of failure are too high, as we have seen in the many thousands of lives lost in Syria. U.S. policy will continue to be measured not only by its willingness to fight but by how effectively it moves to counter troublemakers before trouble happens. An effective president would call a halt to U.S. disarmament, rather than citing it as an accomplishment. He would move to strengthen the hands of America's friends, like the new Ukrainian government and the Kurds of the Middle East, by providing them with economic and military aid. He would abandon the disastrous policy of trying to schmooze and appease cutthroats like Vladimir Putin. Although it might seem too much to ask, an effective president would say to the world that the American politico-economic system still works. That means acknowledging not only today's private-sector achievements, like the boom in domestic natural-gas and oil production due to homegrown technological advancements, but history's lessons as well. In World War II, America quickly became the "Arsenal of Democracy." Its great war machine was created by the inventive know-how and productive skills of millions of private citizens who for generations before the war had seized the opportunities available in a free-market economy to build large mass-production business organizations.

At its best, foreign policy is the sum total of how a nation presents itself to the world's peoples. That includes its quality of life and standard of living, its know-how in producing goods and services, its organizational skills, its cultural and economic creativity. All those things say, "Look at us. You can be happier and healthier if you follow our lead." The American image has been tarnished by the progressives who took control of the U.S. government in 2009. They set about to expand the state's power, which was exactly what had destroyed the productive drive and creative skills of the post-World War II Russians and Chinese. They made a hash of health insurance, grossly distorted finance and destroyed personal savings by manipulation of the credit markets. They conducted a war on fossil fuels, handing a victory to Russia, which uses its hydrocarbon exports to exercise political influence in Europe. They weakened the dollar by running up huge national debts and wasted the nation's substance on silly projects like "fighting global warming." U.S. interests in the Middle East, Asia and Europe are threatened as aggressors and terrorists become bolder. An

American president doesn't have to sit back and watch. The Economist asked a mischievous question, but it revealed a disappointment of the world's expectations of America.

Mr. Melloan, a former columnist and deputy editor of the Journal editorial page, is the author of "The Great Money Binge: Spending Our Way to Socialism" (Simon & Schuster, 2009).

Article 3.

NYT

America and Iran Can Save Iraq

Mohammad Ali Shabani

June 26, 2014 -- To save Iraq from Sunni extremists, Iran is mobilizing its allies in Iraq and promoting collaboration between Iraq's government and Syria. Washington, meanwhile, has dispatched military advisers to Baghdad. On their own, these efforts are valiant. But without coordination, they won't be fruitful.

Iraq was until recently a battleground between Iran and the United States. A string of American military commanders battled Gen. Qassim Suleimani, head of foreign operations for Iran's Islamic Revolutionary Guards, for influence. At the height of the American occupation, Iran's handful of men in Iraq wielded more power than the 150,000 American forces stationed there.

Despite their largely adversarial past, the two countries can now save Iraq if they act together. History has shown that Iran and the United States are capable of pulling Iraq away from the abyss. The civil war that plagued the country from 2006 to 2008 offers lessons in how to stop the current bloodshed.

Back then, Iran was the only country that could pressure Syria to block the Sunni jihadist pipeline, while reining in the Shiite death squads that were bent on ridding the Iraqi capital of Sunnis. And the United States, as an occupying power, was able to approach and co-opt rebellious Sunni tribes. Without coordination, these efforts would have failed.

The head of the Islamic Supreme Council of Iraq at the time, Abdul Aziz al-Hakim, and President Jalal Talabani struggled to get Washington and Tehran to work together. Despite the collapse of the nuclear negotiations that were then taking place between Iran and the European Union, the United States and Iran managed to cooperate.

The first crucial step toward ending the violence was tacit American-Iranian support for Nuri Kamal al-Maliki. After becoming prime minister, Mr. Maliki returned the favor. Within a year of his inauguration, in the summer of 2007, Iranian and American diplomats met in his office — the first senior-level meeting between the two adversaries in almost 30 years.

Mr. Hakim and Mr. Talabani are no longer on the political stage. But Mr. Maliki is. Despite his authoritarian tendencies and his failure to integrate Sunnis into the political process, he remains the least unpopular Iraqi politician today. His success in the April 30 election is proof of that.

And Iran and America still agree on keeping Mr. Maliki in power — largely for lack of better options. Despite rumblings in Congress, Secretary of Defense Chuck Hagel has stated that "the question of whether Maliki should step down is an internal Iraqi matter." And President Obama didn't hesitate to send military personnel back into Iraq.

The outcome of the Sunni offensive is predictable. ISIS will fail in holding and governing captured territory because Iraqi Sunnis are unwilling to conform to the visions of state and society espoused by ISIS. America's earlier success in turning some Iraqi Sunnis against militant extremists is proof, and Mr. Maliki knows this. While Sunni political integration is crucial, violence should not be rewarded with concessions. ISIS and its allies must be repelled from major urban centers and border crossings before any talks with pragmatic militants can occur.

Iraq's Sunnis must either accept the realities of the country's new political order, which is dominated by Shiites and Kurds, or condemn themselves to the perennial instability and violence brought on by the extremists in their ranks and the foreign fighters who have joined them.

The Kurds also face difficult choices. For years they have lived in the twilight between independence and federalism. The United States and Iran must impress upon Kurdish leaders that using the current turmoil to gain concessions from Baghdad on issues such as independent oil exports and the future of the disputed city of Kirkuk will backfire. Washington is loath

to take sides between Erbil and Baghdad. And if it does, it is unlikely to act to antagonize Mr. Maliki. Neither will Tehran.

Iran and America must also manage external spoilers. Saudi Arabia has long seemed unwilling to accept the realities of the new Iraq. But the kingdom can be flexible when intransigence seems self-defeating. Washington must impress upon the Saudis that the fire of extremism will inevitably enter the heart of the Arabian Peninsula unless action is taken to halt support for militancy. Indeed, in a twist of calculations, America may actually now share Iran's interest in seeing ISIS's other major foe, the Syrian regime of Bashar al-Assad, go after Sunni extremists. Mr. Assad's warplanes are now bombing militants on the Iraqi border, which they were not doing last week.

Iran and the United States should also seek to divide ISIS. If the group is only confronted in Iraq, it will withdraw to Syria to return another day. The United States can't and shouldn't act as Iraq's air force. But American military and technological prowess — in the form of sales of drones, helicopters and fighter jets — should be combined with Iranian and Syrian intelligence to prevent the movement of extremists.

Finally, Iran and the United States must boost the Iraqi Army's strength and prevent the rise of militias. Mr. Maliki claims that thousands of volunteers who have signed up to fight ISIS will be the core of the next Iraqi Army, but he needs enough political, military and intelligence help from America and Iran so that he won't have to rely on irregular forces. Any shift away from the army and toward the militias would be profound and unpredictable.

Despite their differences, Tehran and Washington both need a stable Iraq. If not for the good of Iraqis, they should cooperate for the sake of their own interests.

Mohammad Ali Shabani is a doctoral candidate focusing on Iranian policy toward post-Saddam Iraq at the University of London's School of Oriental and African Studies.

Article 4.

The Carnegie Endowment for International Peace

Hezbollah's Iraq Problems

Alexander Corbeil

June 26, 2014 -- Events in Iraq, where the Islamic State of Iraq and al-Sham (ISIS) has routed government forces since June 10, have sent reverberations across the region. In Lebanon, the ISIS victory has sparked fears of increased attacks against Hezbollah for its role in propping up Bashar al-Assad. It has also shifted the order of battle in Syria, increasing Hezbollah's involvement in the conflict and leaving it vulnerable at home. Since ISIS made advances in Iraq, rumors spread that the group was plotting to attack hospitals and institutions affiliated with Hezbollah. Intelligence collected by the CIA and shared with Lebanese authorities pointed to a plot to assassinate parliament speaker and Hezbollah ally Nabih Berri. Hezbollah and security forces have in response stepped up pre-emptive measures, including border patrols, checkpoints, concrete barricades, and raids against terrorist suspects.

These measures have thwarted two attacks aimed at the group. On June 20, a suicide bomber detonated his payload at a checkpoint in Dahr al-Baidar, on the road between Beirut and Damascus, killing a 49-year-old Internal Security Forces officer and wounding 32 others, making it the first suicide bomb to hit Lebanon in twelve weeks. The bomber had purportedly turned back toward the Bekaa Valley after failing to pass other checkpoints into Beirut. On June 23, another bomb detonated in the Tayyouneh area, near a military checkpoint at the entrance to Beirut's southern suburbs, Hezbollah's stronghold. Again, the assailant was unable to reach his intended target.

Since July of last year, Hezbollah has been a frequent victim of car bombings, six of which hit its stronghold of Dahyeh. Radical Sunni groups carried out the majority of the attacks, and at least one was claimed by ISIS. In November, a Syrian government campaign with the support of Hezbollah allowed them to retake the town of Yabroud in Syria's mountainous Qalamoun region, a crucial car-bomb-making hub for those targeting Hezbollah in the Bekaa Valley and in Beirut. Combined with a security plan enacted by Lebanese security forces in Tripoli and the Bekaa to stop spillover from the Qalamoun offensive and pacify these areas,

Lebanon witnessed a sharp reduction in attacks against Hezbollah. Yet this latest uptick in violence indicates that events in Iraq have, at least temporarily, breathed new life into the fight against the Lebanese militia.
A crucial component of the campaign to take Yabroud was the participation of Shia militias from Iraq. Since May of last year—when Hezbollah took an increasingly public role in defense of the Assad regime—the group has quickly become interoperable with these Shia militias. At the behest of Iran, Hezbollah militiamen have trained, fought alongside, and led these Iraqi fighters. Their cooperation and integration have been crucial in regime victories in Damascus, Homs, and Aleppo, key battlegrounds in Assad's strategy of attrition. The presence of the Iraqi militias allowed Hezbollah's smaller force, with remnants of Syria's elite and other loyalist units, to spearhead assaults and then turn over captured ground to their less experienced allies, who are now decamping for home.
Since late December, Shia militiamen have returned to Iraq to defend the government of Nouri al-Maliki against the ISIS-led insurgency in the country's west. Given the lightening-speed advance of ISIS this month, threats to destroy Shia holy sites, and a call to arms by Grand Ayatollah Ali al-Sistani, Iraqi militiamen are now flowing back into their home country to stop the extremist advance. This coordinated exodus from the Syrian campaign has already seen up to 1,000 Iraqi fighters depart, creating a gap in the Syrian regime's battle plan, one which both Assad and Iran have looked to Hezbollah to fill.
Hezbollah has already sent about 1,000 fighters to defend Shia shrines in Syria, a cover story for its increasing involvement in the conflict. Because Iraqi Shia fighters in Syria are estimated at around 8,000, including groups such as Liwa Abu Fadl al-Abbas (LAFA) and Asa'ib Ahl al-Haq, replacing these fighters will demand a much larger commitment from Hezbollah cadres and will, in the interim, leave Hezbollah short on manpower in Syria and at home.
Recently, Hezbollah has come under increased attack in the Qalamoun region, likely a result of the exodus of Iraqi militiamen and the associated security gap. The Syrian Observatory for Human Rights claimed on June 11 that fourteen Hezbollah fighters had been killed during a rebel assault in the region, while rebels claimed the number stood higher, at 29. In response to these attacks around Rankous and Asal al-Ward, the Syrian

regime and Hezbollah launched an offensive on June 21 to clear Qalamoun, where an estimated 3,000 rebel fighters remain. Tony Badran, a Hezbollah expert with the Foundation for Defense of Democracies, believes that the group will make use of its relationship with the Lebanese Armed Forces (LAF) to secure the Lebanese side of the Qalamoun region.1 The joint Syria-Hezbollah assault on Qalamoun now looks in part to be a pre-emptive move to make up for the current destabilizing shifts in manpower and to secure the border area, at a time when Hezbollah's involvement in Syria is becoming more important to the Assad regime. While it is unclear how long it will take for this campaign to unfold, it is clear that Hezbollah's contribution to capturing and holding these troubled areas will increase and in turn become more flagrant as sectarian tensions mount.

At home, Hezbollah will come to rely more heavily on its reserves to fill the gap left by Iraqi groups, adding to its contingent of 5,000 fighters in the country. This will further stretch the capacities of the group, many members of which are already fatigued with the fighting in Syria, and it will also renew the Shia community's fears of being targeted by Syrian rebels and their Lebanese allies. Meanwhile, if the Qalamoun campaign unfolds with the tacit involvement of the LAF, many within Lebanon's Sunni community will point to Hezbollah-LAF cooperation as further evidence of Shia dominance of the country's political system and its security institutions.

Hezbollah's Secretary General, Hassan Nasrallah, recently boasted during a leadership meeting, "We are ready to sacrifice martyrs in Iraq five times more than what we sacrificed in Syria…" Given Hezbollah's deepening involvement in Syria and the heightened state of security within Lebanon, the group's ability to send any large contingent to protect Iraq's Shia holy sites seems unrealistic. It now seems that Hezbollah will be dealing with its Iraq problems more so at home and in Syria than in Iraq.

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Article 5.

The Washington Post

Hillary Clinton's truly hard choice: Change or continuity?

Fareed Zakaria

June 26 -- Hillary Clinton's problem is not her money. Despite the media flurry over a couple of awkward remarks she made, most people will understand her situation pretty quickly — she wasn't born rich but has become very rich — and are unlikely to hold it against her. Mitt Romney did not lose the last election because of his wealth. Hispanics and Asians did not vote against him in record numbers because he was a successful businessman. Clinton's great challenge will be to decide whether she represents change or continuity.

Clinton will make history in a big and dramatic way if she is elected — as the first woman president. But she will make history in a smaller, more complicated sense as well. She would join just three other non-incumbents since 1900 to win the White House after their party had been in power for eight years. She would be the first to win who was not the vice president or the clear protégé of the incumbent president.

The examples will clarify. Since 1900, the three were William Howard Taft, Herbert Hoover and George H.W. Bush. Six others tried and lost: James Cox, Adlai Stevenson, Richard Nixon, Hubert Humphrey, Al Gore and John McCain. Interestingly, even the three successful ones had only one term as president.

A caveat: Beware of any grand pronouncements about the presidency because in statistical terms there have not been enough examples, and if you vary the criteria, you can always find an interesting pattern. The Republican Party broke almost every rule between 1861 and 1933, during which it held the presidency for 52 of the 72 years.

But the challenge for Clinton can be seen through the prism of her predecessors — should she run on change or continuity? The three who won all pledged to extend the president's policies. They also ran in economic good times with popular presidents. That's not always a guarantee, of course. Cox promised to be "a million percent" behind Woodrow Wilson's policies, but since Wilson was by then wildly

unpopular for his signature policy, the League of Nations, Cox received the most resounding drubbing (in the popular vote) in history.

Some of the candidates had an easier time distancing themselves from unpopular presidents. McCain was clearly a rival and opponent of George W. Bush. Stevenson was very different from Harry Truman, but he was, in effect, asking for not a third term for the Democrats but a sixth term — after 20 years of Franklin Delano Roosevelt and Truman. Shortly before the 1952 election, Stevenson wrote to the Oregon Journal that "the thesis 'time for a change' is the principal obstacle ahead" for his campaign. After all, if the country wants change, it will probably vote for the other party. "It's time for a change" was Dwight Eisenhower's official campaign slogan in 1952.

The most awkward circumstance has been for vice presidents trying to distance themselves from their bosses. Humphrey tried mightily to explain that he was different from Lyndon Johnson without criticizing the latter. "One does not repudiate his family in order to establish his own identity," he would say. Gore faced the same problem in 2000, though many believe that he should not have tried to distance himself so much from a popular president who had presided over good times. As Michael Kinsley noted, Gore's often fiery and populist campaign seemed to have as its slogan: "You've never had it so good, and [redacted] mad as hell about it."

Today the country is in a slow recovery and President Obama's approval ratings are low. This might suggest that the best course would be for Clinton to distance herself from her former boss. But Obamacare and other policies of this president are very popular among many Democratic groups. Again, the three people in her shoes who won all ran on continuity.

Clinton's recent memoir suggests that she has not yet made up her mind as to what course she will follow. The book is a carefully calibrated mixture of praise and criticism, loyalty and voice, such that she can plausibly go in whatever direction she chooses.

The world today is different. And Clinton is in a unique position, especially if she can truly mobilize women voters. But history suggests that choosing change or continuity will truly be her hard choice.

Article 6.

The Atlantic

Secrets of the Creative Brain

Nancy Andreasen

June 25, 2014 -- As a psychiatrist and neuroscientist who studies creativity, I've had the pleasure of working with many gifted and high-profile subjects over the years, but Kurt Vonnegut—dear, funny, eccentric, lovable, tormented Kurt Vonnegut—will always be one of my favorites. Kurt was a faculty member at the Iowa Writers' Workshop in the 1960s, and participated in the first big study I did as a member of the university's psychiatry department. I was examining the anecdotal link between creativity and mental illness, and Kurt was an excellent case study.

He was intermittently depressed, but that was only the beginning. His mother had suffered from depression and committed suicide on Mother's Day, when Kurt was 21 and home on military leave during World War II. His son, Mark, was originally diagnosed with schizophrenia but may actually have bipolar disorder. (Mark, who is a practicing physician, recounts his experiences in two books, The Eden Express and Just Like Someone Without Mental Illness Only More So, in which he reveals that many family members struggled with psychiatric problems. "My mother, my cousins, and my sisters weren't doing so great," he writes. "We had eating disorders, co-dependency, outstanding warrants, drug and alcohol problems, dating and employment problems, and other 'issues.' ")

While mental illness clearly runs in the Vonnegut family, so, I found, does creativity. Kurt's father was a gifted architect, and his older brother Bernard was a talented physical chemist and inventor who possessed 28 patents. Mark is a writer, and both of Kurt's daughters are visual artists. Kurt's work, of course, needs no introduction.

For many of my subjects from that first study—all writers associated with the Iowa Writers' Workshop—mental illness and creativity went hand in hand. This link is not surprising. The archetype of the mad genius dates back to at least classical times, when Aristotle noted, "Those who have been eminent in philosophy, politics, poetry, and the arts have all had tendencies toward melancholia." This pattern is a recurring theme in Shakespeare's plays, such as when Theseus, in A Midsummer Night's Dream, observes, "The lunatic, the lover, and the poet / Are of imagination

all compact." John Dryden made a similar point in a heroic couplet: "Great wits are sure to madness near allied, / And thin partitions do their bounds divide."

Compared with many of history's creative luminaries, Vonnegut, who died of natural causes, got off relatively easy. Among those who ended up losing their battles with mental illness through suicide are Virginia Woolf, Ernest Hemingway, Vincent van Gogh, John Berryman, Hart Crane, Mark Rothko, Diane Arbus, Anne Sexton, and Arshile Gorky.

My interest in this pattern is rooted in my dual identities as a scientist and a literary scholar. In an early parallel with Sylvia Plath, a writer I admired, I studied literature at Radcliffe and then went to Oxford on a Fulbright scholarship; she studied literature at Smith and attended Cambridge on a Fulbright. Then our paths diverged, and she joined the tragic list above. My curiosity about our different outcomes has shaped my career. I earned a doctorate in literature in 1963 and joined the faculty of the University of Iowa to teach Renaissance literature. At the time, I was the first woman the university's English department had ever hired into a tenure-track position, and so I was careful to publish under the gender-neutral name of N. J. C. Andreasen.

Not long after this, a book [redacted] written about the poet John Donne was accepted for publication by Princeton University Press. Instead of feeling elated, I felt almost ashamed and self-indulgent. Who would this book help? What if I channeled the effort and energy [redacted] invested in it into a career that might save people's lives? Within a month, I made the decision to become a research scientist, perhaps a medical doctor. I entered the University of Iowa's medical school, in a class that included only five other women, and began working with patients suffering from schizophrenia and mood disorders. I was drawn to psychiatry because at its core is the most interesting and complex organ in the human body: the brain.

I have spent much of my career focusing on the neuroscience of mental illness, but in recent decades I've also focused on what we might call the science of genius, trying to discern what combination of elements tends to produce particularly creative brains. What, in short, is the essence of creativity? Over the course of my life, I've kept coming back to two more-specific questions: What differences in nature and nurture can explain why some people suffer from mental illness and some do not? And why are so

many of the world's most creative minds among the most afflicted? My latest study, for which I've been scanning the brains of some of today's most illustrious scientists, mathematicians, artists, and writers, has come closer to answering this second question than any other research to date.
The first attempted examinations of the connection between genius and insanity were largely anecdotal. In his 1891 book, The Man of Genius, Cesare Lombroso, an Italian physician, provided a gossipy and expansive account of traits associated with genius—left-handedness, celibacy, stammering, precocity, and, of course, neurosis and psychosis—and he linked them to many creative individuals, including Jean-Jacques Rousseau, Sir Isaac Newton, Arthur Schopenhauer, Jonathan Swift, Charles Darwin, Lord Byron, Charles Baudelaire, and Robert Schumann.
Lombroso speculated on various causes of lunacy and genius, ranging from heredity to urbanization to climate to the phases of the moon. He proposed a close association between genius and degeneracy and argued that both are hereditary.
Francis Galton, a cousin of Charles Darwin, took a much more rigorous approach to the topic. In his 1869 book, Hereditary Genius, Galton used careful documentation—including detailed family trees showing the more than 20 eminent musicians among the Bachs, the three eminent writers among the Brontës, and so on—to demonstrate that genius appears to have a strong genetic component. He was also the first to explore in depth the relative contributions of nature and nurture to the development of genius.
"Doing good science is … like having good sex. It excites you all over and makes you feel as if you are all-powerful and complete."
As research methodology improved over time, the idea that genius might be hereditary gained support. For his 1904 Study of British Genius, the English physician Havelock Ellis twice reviewed the 66 volumes of The Dictionary of National Biography. In his first review, he identified individuals whose entries were three pages or longer. In his second review, he eliminated those who "displayed no high intellectual ability" and added those who had shorter entries but showed evidence of "intellectual ability of high order." His final list consisted of 1,030 individuals, only 55 of whom were women. Much like Lombroso, he examined how heredity, general health, social class, and other factors may have contributed to his subjects' intellectual distinction. Although Ellis's approach was

resourceful, his sample was limited, in that the subjects were relatively famous but not necessarily highly creative. He found that 8.2 percent of his overall sample of 1,030 suffered from melancholy and 4.2 percent from insanity. Because he was relying on historical data provided by the authors of The Dictionary of National Biography rather than direct contact, his numbers likely underestimated the prevalence of mental illness in his sample.

A more empirical approach can be found in the early-20th-century work of Lewis M. Terman, a Stanford psychologist whose multivolume Genetic Studies of Genius is one of the most legendary studies in American psychology. He used a longitudinal design—meaning he studied his subjects repeatedly over time—which was novel then, and the project eventually became the longest-running longitudinal study in the world. Terman himself had been a gifted child, and his interest in the study of genius derived from personal experience. (Within six months of starting school, at age 5, Terman was advanced to third grade—which was not seen at the time as a good thing; the prevailing belief was that precocity was abnormal and would produce problems in adulthood.) Terman also hoped to improve the measurement of "genius" and test Lombroso's suggestion that it was associated with degeneracy.

In 1916, as a member of the psychology department at Stanford, Terman developed America's first IQ test, drawing from a version developed by the French psychologist Alfred Binet. This test, known as the Stanford-Binet Intelligence Scales, contributed to the development of the Army Alpha, an exam the American military used during World War I to screen recruits and evaluate them for work assignments and determine whether they were worthy of officer status.

Terman eventually used the Stanford-Binet test to select high-IQ students for his longitudinal study, which began in 1921. His long-term goal was to recruit at least 1,000 students from grades three through eight who represented the smartest 1 percent of the urban California population in that age group. The subjects had to have an IQ greater than 135, as measured by the Stanford-Binet test. The recruitment process was intensive: students were first nominated by teachers, then given group tests, and finally subjected to individual Stanford-Binet tests. After various enrichments—adding some of the subjects' siblings, for example—the final

sample consisted of 856 boys and 672 girls. One finding that emerged quickly was that being the youngest student in a grade was an excellent predictor of having a high IQ. (This is worth bearing in mind today, when parents sometimes choose to hold back their children precisely so they will not be the youngest in their grades.)

These children were initially evaluated in all sorts of ways. Researchers took their early developmental histories, documented their play interests, administered medical examinations—including 37 different anthropometric measurements—and recorded how many books [redacted] read during the past two months, as well as the number of books available in their homes (the latter number ranged from zero to 6,000, with a mean of 328). These gifted children were then reevaluated at regular intervals throughout their lives. If having a very high IQ was not what made these writers creative, then what was?

"The Termites," as Terman's subjects have come to be known, have debunked some stereotypes and introduced new paradoxes. For example, they were generally physically superior to a comparison group—taller, healthier, more athletic. Myopia (no surprise) was the only physical deficit. They were also more socially mature and generally better adjusted. And these positive patterns persisted as the children grew into adulthood. They tended to have happy marriages and high salaries. So much for the concept of "early ripe and early rotten," a common assumption when Terman was growing up.

But despite the implications of the title Genetic Studies of Genius, the Termites' high IQs did not predict high levels of creative achievement later in life. Only a few made significant creative contributions to society; none appear to have demonstrated extremely high creativity levels of the sort recognized by major awards, such as the Nobel Prize. (Interestingly, William Shockley, who was a 12-year-old Palo Alto resident in 1922, somehow failed to make the cut for the study, even though he would go on to share a Nobel Prize in physics for the invention of the transistor.) Thirty percent of the men and 33 percent of the women did not even graduate from college. A surprising number of subjects pursued humble occupations, such as semiskilled trades or clerical positions. As the study evolved over the years, the term gifted was substituted for genius. Although many people continue to equate intelligence with genius, a crucial conclusion from

Terman's study is that having a high IQ is not equivalent to being highly creative. Subsequent studies by other researchers have reinforced Terman's conclusions, leading to what's known as the threshold theory, which holds that above a certain level, intelligence doesn't have much effect on creativity: most creative people are pretty smart, but they don't have to be that smart, at least as measured by conventional intelligence tests. An IQ of 120, indicating that someone is very smart but not exceptionally so, is generally considered sufficient for creative genius.

But if high IQ does not indicate creative genius, then what does? And how can one identify creative people for a study?

One approach, which is sometimes referred to as the study of "little c," is to develop quantitative assessments of creativity—a necessarily controversial task, given that it requires settling on what creativity actually is. The basic concept that has been used in the development of these tests is skill in "divergent thinking," or the ability to come up with many responses to carefully selected questions or probes, as contrasted with "convergent thinking," or the ability to come up with the correct answer to problems that have only one answer. For example, subjects might be asked, "How many uses can you think of for a brick?" A person skilled in divergent thinking might come up with many varied responses, such as building a wall; edging a garden; and serving as a bludgeoning weapon, a makeshift shot put, a bookend. Like IQ tests, these exams can be administered to large groups of people. Assuming that creativity is a trait everyone has in varying amounts, those with the highest scores can be classified as exceptionally creative and selected for further study.

While this approach is quantitative and relatively objective, its weakness is that certain assumptions must be accepted: that divergent thinking is the essence of creativity, that creativity can be measured using tests, and that high-scoring individuals are highly creative people. One might argue that some of humanity's most creative achievements have been the result of convergent thinking—a process that led to Newton's recognition of the physical formulae underlying gravity, and Einstein's recognition that $E=mc^2$.

A second approach to defining creativity is the "duck test": if it walks like a duck and quacks like a duck, it must be a duck. This approach usually involves selecting a group of people—writers, visual artists, musicians,

inventors, business innovators, scientists—who have been recognized for some kind of creative achievement, usually through the awarding of major prizes (the Nobel, the Pulitzer, and so forth). Because this approach focuses on people whose widely recognized creativity sets them apart from the general population, it is sometimes referred to as the study of "big C." The problem with this approach is its inherent subjectivity. What does it mean, for example, to have "created" something? Can creativity in the arts be equated with creativity in the sciences or in business, or should such groups be studied separately? For that matter, should science or business innovation be considered creative at all?

Although I recognize and respect the value of studying "little c," I am an unashamed advocate of studying "big C." I first used this approach in the mid-1970s and 1980s, when I conducted one of the first empirical studies of creativity and mental illness. Not long after I joined the psychiatry faculty of the Iowa College of Medicine, I ran into the chair of the department, a biologically oriented psychiatrist known for his salty language and male chauvinism. "Andreasen," he told me, "you may be an [redacted]./[redacted]., but that [redacted]. of yours isn't worth sh--, and it won't count favorably toward your promotion." I was proud of my literary background and believed that it made me a better clinician and a better scientist, so I decided to prove him wrong by using my background as an entry point to a scientific study of genius and insanity.

The University of Iowa is home to the Writers' Workshop, the oldest and most famous creative-writing program in the United States (UNESCO has designated Iowa City as one of its seven "Cities of Literature," along with the likes of Dublin and Edinburgh). Thanks to my time in the university's English department, I was able to recruit study subjects from the workshop's ranks of distinguished permanent and visiting faculty. Over the course of 15 years, I studied not only Kurt Vonnegut but Richard Yates, John Cheever, and 27 other well-known writers.

Going into the study, I keyed my hypotheses off the litany of famous people who I knew had personal or family histories of mental illness. James Joyce, for example, had a daughter who suffered from schizophrenia, and he himself had traits that placed him on the schizophrenia spectrum. (He was socially aloof and even cruel to those close to him, and his writing became progressively more detached from his

audience and from reality, culminating in the near-psychotic neologisms and loose associations of Finnegans Wake.) Bertrand Russell, a philosopher whose work I admired, had multiple family members who suffered from schizophrenia. Einstein had a son with schizophrenia, and he himself displayed some of the social and interpersonal ineptitudes that can characterize the illness. Based on these clues, I hypothesized that my subjects would have an increased rate of schizophrenia in family members but that they themselves would be relatively well. I also hypothesized that creativity might run in families, based on prevailing views that the tendencies toward psychosis and toward having creative and original ideas were closely linked.

I began by designing a standard interview for my subjects, covering topics such as developmental, social, family, and psychiatric history, and work habits and approach to writing. Drawing on creativity studies done by the psychiatric epidemiologist Thomas McNeil, I evaluated creativity in family members by assigning those who had had very successful creative careers an A++ rating and those who had pursued creative interests or hobbies an A+.

My final challenge was selecting a control group. After entertaining the possibility of choosing a homogeneous group whose work is not usually considered creative, such as lawyers, I decided that it would be best to examine a more varied group of people from a mixture of professions, such as administrators, accountants, and social workers. I matched this control group with the writers according to age and educational level. By matching based on education, I hoped to match for IQ, which worked out well; both the test and the control groups had an average IQ of about 120. These results confirmed Terman's findings that creative genius is not the same as high IQ. If having a very high IQ was not what made these writers creative, then what was?

As I began interviewing my subjects, I soon realized that I would not be confirming my schizophrenia hypothesis. If I had paid more attention to Sylvia Plath and Robert Lowell, who both suffered from what we today call mood disorder, and less to James Joyce and Bertrand Russell, I might have foreseen this. One after another, my writer subjects came to my office and spent three or four hours pouring out the stories of their struggles with mood disorder—mostly depression, but occasionally bipolar disorder. A

full 80 percent of them had had some kind of mood disturbance at some time in their lives, compared with just 30 percent of the control group—only slightly less than an age-matched group in the general population. (At first I had been surprised that nearly all the writers I approached would so eagerly agree to participate in a study with a young and unknown assistant professor—but I quickly came to understand why they were so interested in talking to a psychiatrist.) The Vonneguts turned out to be representative of the writers' families, in which both mood disorder and creativity were overrepresented—as with the Vonneguts, some of the creative relatives were writers, but others were dancers, visual artists, chemists, architects, or mathematicians. This is consistent with what some other studies have found. When the psychologist Kay Redfield Jamison looked at 47 famous writers and artists in Great Britain, she found that more than 38 percent had been treated for a mood disorder; the highest rates occurred among playwrights, and the second-highest among poets. When Joseph Schildkraut, a psychiatrist at Harvard Medical School, studied a group of 15 abstract-expressionist painters in the mid-20th century, he found that half of them had some form of mental illness, mostly depression or bipolar disorder; nearly half of these artists failed to live past age 60.

While my workshop study answered some questions, it raised others. Why does creativity run in families? What is it that gets transmitted? How much is due to nature and how much to nurture? Are writers especially prone to mood disorders because writing is an inherently lonely and introspective activity? What would I find if I studied a group of scientists instead? These questions percolated in my mind in the weeks, months, and eventually years after the study. As I focused my research on the neurobiology of severe mental illnesses, including schizophrenia and mood disorders, studying the nature of creativity—important as the topic was and is—seemed less pressing than searching for ways to alleviate the suffering of patients stricken with these dreadful and potentially lethal brain disorders. During the 1980s, new neuroimaging techniques gave researchers the ability to study patients' brains directly, an approach I began using to answer questions about how and why the structure and functional activity of the brain is disrupted in some people with serious mental illnesses.

Capturing human mental processes can be like capturing quicksilver. The brain has as many neurons as there are stars in the Milky Way.

As I spent more time with neuroimaging technology, I couldn't help but wonder what we would find if we used it to look inside the heads of highly creative people. Would we see a little genie that doesn't exist inside other people's heads?

Today's neuroimaging tools show brain structure with a precision approximating that of the examination of post-mortem tissue; this allows researchers to study all sorts of connections between brain measurements and personal characteristics. For example, we know that London taxi drivers, who must memorize maps of the city to earn a hackney's license, have an enlarged hippocampus—a key memory region—as demonstrated in a magnetic-resonance-imaging, or MRI, study. (They know it, too: on a recent trip to London, I was proudly regaled with this information by several different taxi drivers.) Imaging studies of symphony-orchestra musicians have found them to possess an unusually large Broca's area—a part of the brain in the left hemisphere that is associated with language—along with other discrepancies. Using another technique, functional magnetic resonance imaging (fMRI), we can watch how the brain behaves when engaged in thought.

Designing neuroimaging studies, however, is exceedingly tricky. Capturing human mental processes can be like capturing quicksilver. The brain has as many neurons as there are stars in the Milky Way, each connected to other neurons by billions of spines, which contain synapses that change continuously depending on what the neurons have recently learned. Capturing brain activity using imaging technology inevitably leads to oversimplifications, as sometimes evidenced by news reports that an investigator has found the location of something—love, guilt, decision making—in a single region of the brain.

And what are we even looking for when we search for evidence of "creativity" in the brain? Although we have a definition of creativity that many people accept—the ability to produce something that is novel or original and useful or adaptive—achieving that "something" is part of a complex process, one often depicted as an "aha" or "eureka" experience. This narrative is appealing—for example, "Newton developed the concept of gravity around 1666, when an apple fell on his head while he was

meditating under an apple tree." The truth is that by 1666, Newton had already spent many years teaching himself the mathematics of his time (Euclidean geometry, algebra, Cartesian coordinates) and inventing calculus so that he could measure planetary orbits and the area under a curve. He continued to work on his theory of gravity over the subsequent years, completing the effort only in 1687, when he published Philosophiœ Naturalis Principia Mathematica. In other words, Newton's formulation of the concept of gravity took more than 20 years and included multiple components: preparation, incubation, inspiration—a version of the eureka experience—and production. Many forms of creativity, from writing a novel to discovering the structure of DNA, require this kind of ongoing, iterative process.

With functional magnetic resonance imaging, the best we can do is capture brain activity during brief moments in time while subjects are performing some task. For instance, observing brain activity while test subjects look at photographs of their relatives can help answer the question of which parts of the brain people use when they recognize familiar faces. Creativity, of course, cannot be distilled into a single mental process, and it cannot be captured in a snapshot—nor can people produce a creative insight or thought on demand. I spent many years thinking about how to design an imaging study that could identify the unique features of the creative brain. The images on the left show the brain of a creative subject (top) and a matched control subject during a word-association task. The images on the right show brain activation as the subjects alternate between an experimental task (word association) and a control task (reading a word). The line representing the creative subject's brain activation moves smoothly up and down as the task changes, reflecting effective use of the association cortices in making connections. The control subject's activation line looks ragged by comparison.

Most of the human brain's high-level functions arise from the six layers of nerve cells and their dendrites embedded in its enormous surface area, called the cerebral cortex, which is compressed to a size small enough to be carried around on our shoulders through a process known as gyrification —essentially, producing lots of folds. Some regions of the brain are highly specialized, receiving sensory information from our eyes, ears, skin, mouth, or nose, or controlling our movements. We call these regions the

primary visual, auditory, sensory, and motor cortices. They collect information from the world around us and execute our actions. But we would be helpless, and effectively nonhuman, if our brains consisted only of these regions.

In fact, the most extensively developed regions in the human brain are known as association cortices. These regions help us interpret and make use of the specialized information collected by the primary visual, auditory, sensory, and motor regions. For example, as you read these words on a page or a screen, they register as black lines on a white background in your primary visual cortex. If the process stopped at that point, you wouldn't be reading at all. To read, your brain, through miraculously complex processes that scientists are still figuring out, needs to forward those black letters on to association-cortex regions such as the angular gyrus, so that meaning is attached to them; and then on to language-association regions in the temporal lobes, so that the words are connected not only to one another but also to their associated memories and given richer meanings. These associated memories and meanings constitute a "verbal lexicon," which can be accessed for reading, speaking, listening, and writing. Each person's lexicon is a bit different, even if the words themselves are the same, because each person has different associated memories and meanings. One difference between a great writer like Shakespeare and, say, the typical stockbroker is the size and richness of the verbal lexicon in his or her temporal association cortices, as well as the complexity of the cortices' connections with other association regions in the frontal and parietal lobes.

A neuroimaging study I conducted in 1995 using positron-emission tomography, or PET, scanning turned out to be unexpectedly useful in advancing my own understanding of association cortices and their role in the creative process.

This PET study was designed to examine the brain's different memory systems, which the great Canadian psychologist Endel Tulving identified. One system, episodic memory, is autobiographical—it consists of information linked to an individual's personal experiences. It is called "episodic" because it consists of time-linked sequential information, such as the events that occurred on a person's wedding day. My team and I compared this with another system, that of semantic memory, which is a repository of general information and is not personal or time-linked. In this

study, we divided episodic memory into two subtypes. We examined focused episodic memory by asking subjects to recall a specific event that had occurred in the past and to describe it with their eyes closed. And we examined a condition that we called random episodic silent thought, or REST: we asked subjects to lie quietly with their eyes closed, to relax, and to think about whatever came to mind. In essence, they would be engaged in "free association," letting their minds wander. The acronym REST was intentionally ironic; we suspected that the association regions of the brain would actually be wildly active during this state.

When eureka moments occur, they tend to be precipitated by long periods of preparation and incubation, and to strike when the mind is relaxed. This suspicion was based on what we had learned about free association from the psychoanalytic approach to understanding the mind. In the hands of Freud and other psychoanalysts, free association—spontaneously saying whatever comes to mind without censorship—became a window into understanding unconscious processes. Based on my interviews with the creative subjects in my workshop study, and from additional conversations with artists, I knew that such unconscious processes are an important component of creativity. For example, Neil Simon told me: "I don't write consciously—it is as if the muse sits on my shoulder" and "I slip into a state that is apart from reality." (Examples from history suggest the same thing. Samuel Taylor Coleridge once described how he composed an entire 300-line poem about Kubla Khan while in an opiate-induced, dreamlike state, and began writing it down when he awoke; he said he then lost most of it when he got interrupted and called away on an errand—thus the finished poem he published was but a fragment of what originally came to him in his dreamlike state.)

Based on all this, I surmised that observing which parts of the brain are most active during free association would give us clues about the neural basis of creativity. And what did we find? Sure enough, the association cortices were wildly active during REST.

I realized that I obviously couldn't capture the entire creative process—instead, I could home in on the parts of the brain that make creativity possible. Once I arrived at this idea, the design for the imaging studies was obvious: I needed to compare the brains of highly creative people with

those of control subjects as they engaged in tasks that activated their association cortices.

from the atlantic archives

“Women Must Weep” by Virginia Woolf

In 1938, the author entreated “daughters of educated men” to oppose the fighting in Europe. She committed suicide three years later, in the midst of World War II.

Download the PDF (Part 1 and Part 2)

For years, I had been asking myself what might be special or unique about the brains of the workshop writers I had studied. In my own version of a eureka moment, the answer finally came to me: creative people are better at recognizing relationships, making associations and connections, and seeing things in an original way—seeing things that others cannot see. To test this capacity, I needed to study the regions of the brain that go crazy when you let your thoughts wander. I needed to target the association cortices. In addition to REST, I could observe people performing simple tasks that are easy to do in an MRI scanner, such as word association, which would permit me to compare highly creative people—who have that “genie in the brain”—with the members of a control group matched by age and education and gender, people who have “ordinary creativity” and who have not achieved the levels of recognition that characterize highly creative people. I was ready to design Creativity Study II.

This time around, I wanted to examine a more diverse sample of creativity, from the sciences as well as the arts. My motivations were partly selfish—I wanted the chance to discuss the creative process with people who might think and work differently, and I thought I could probably learn a lot by listening to just a few people from specific scientific fields. After all, each would be an individual jewel—a fascinating study on his or her own. Now that [redacted] about halfway through the study, I can say that this is exactly what has happened. My individual jewels so far include, among others, the filmmaker George Lucas, the mathematician and Fields Medalist William Thurston, the Pulitzer Prize–winning novelist Jane Smiley, and six Nobel laureates from the fields of chemistry, physics, and physiology or medicine. Because winners of major awards are typically older, and because I wanted to include some younger people, I’ve also recruited

winners of the National Institutes of Health Pioneer Award and other prizes in the arts.

Apart from stating their names, I do not have permission to reveal individual information about my subjects. And because the study is ongoing (each subject can take as long as a year to recruit, making for slow progress), we do not yet have any definitive results—though we do have a good sense of the direction that things are taking. By studying the structural and functional characteristics of subjects' brains in addition to their personal and family histories, we are learning an enormous amount about how creativity occurs in the brain, as well as whether these scientists and artists display the same personal or familial connections to mental illness that the subjects in my Iowa Writers' Workshop study did.

To participate in the study, each subject spends three days in Iowa City, since it is important to conduct the research using the same MRI scanner. The subjects and I typically get to know each other over dinner at my home (and a bottle of Bordeaux from my cellar), and by prowling my 40-acre nature retreat in an all-terrain vehicle, observing whatever wildlife happens to be wandering around. Relaxing together and getting a sense of each other's human side is helpful going into the day and a half of brain scans and challenging conversations that will follow.

Having too many ideas can be dangerous. Part of what comes with seeing connections no one else sees is that not all of these connections actually exist.

We begin the actual study with an MRI scan, during which subjects perform three different tasks, in addition to REST: word association, picture association, and pattern recognition. Each experimental task alternates with a control task; during word association, for example, subjects are shown words on a screen and asked to either think of the first word that comes to mind (the experimental task) or silently repeat the word they see (the control task). Speaking disrupts the scanning process, so subjects silently indicate when they have completed a task by pressing a button on a keypad.

Playing word games inside a thumping, screeching hollow tube seems like a far cry from the kind of meandering, spontaneous discovery process that we tend to associate with creativity. It is, however, as close as one can come to a proxy for that experience, apart from REST. You cannot force

creativity to happen—every creative person can attest to that. But the essence of creativity is making connections and solving puzzles. The design of these MRI tasks permits us to visualize what is happening in the creative brain when it's doing those things.

As I hypothesized, the creative people have shown stronger activations in their association cortices during all four tasks than the controls have. (See the images on page 74.) This pattern has held true for both the artists and the scientists, suggesting that similar brain processes may underlie a broad spectrum of creative expression. Common stereotypes about "right brained" versus "left brained" people notwithstanding, this parallel makes sense. Many creative people are polymaths, people with broad interests in many fields—a common trait among my study subjects.

After the brain scans, I settle in with subjects for an in-depth interview. Preparing for these interviews can be fun (rewatching all of George Lucas's films, for example, or reading Jane Smiley's collected works) as well as challenging (toughing through mathematics papers by William Thurston). I begin by asking subjects about their life history—where they grew up, where they went to school, what activities they enjoyed. I ask about their parents—their education, occupation, and parenting style—and about how the family got along. I learn about brothers, sisters, and children, and get a sense for who else in a subject's family is or has been creative and how creativity may have been nurtured at home. We talk about how the subjects managed the challenges of growing up, any early interests and hobbies (particularly those related to the creative activities they pursue as adults), dating patterns, life in college and graduate school, marriages, and child-rearing. I ask them to describe a typical day at work and to think through how they have achieved such a high level of creativity. (One thing I've learned from this line of questioning is that creative people work much harder than the average person—and usually that's because they love their work.)

One of the most personal and sometimes painful parts of the interview is when I ask about mental illness in subjects' families as well as in their own lives. They've told me about such childhood experiences as having a mother commit suicide or watching ugly outbreaks of violence between two alcoholic parents, and the pain and scars that these experiences have inflicted. (Two of the 13 creative subjects in my current study have lost a

parent to suicide—a rate many times that of the general U.S. population.) Talking with those subjects who have suffered from a mental illness themselves, I hear about how it has affected their work and how they have learned to cope.

So far, this study—which has examined 13 creative geniuses and 13 controls—has borne out a link between mental illness and creativity similar to the one I found in my Writers' Workshop study. The creative subjects and their relatives have a higher rate of mental illness than the controls and their relatives do (though not as high a rate as I found in the first study), with the frequency being fairly even across the artists and the scientists. The most-common diagnoses include bipolar disorder, depression, anxiety or panic disorder, and alcoholism. I've also found some evidence supporting my early hypothesis that exceptionally creative people are more likely than control subjects to have one or more first-degree relatives with schizophrenia. Interestingly, when the physician and researcher Jon L. Karlsson examined the relatives of everyone listed in Iceland's version of Who's Who in the 1940s and '60s, he found that they had higher-than-average rates of schizophrenia. Leonard Heston, a former psychiatric colleague of mine at Iowa, conducted an influential study of the children of schizophrenic mothers raised from infancy by foster or adoptive parents, and found that more than 10 percent of these children developed schizophrenia, as compared with zero percent of a control group. This suggests a powerful genetic component to schizophrenia. Heston and I discussed whether some particularly creative people owe their gifts to a subclinical variant of schizophrenia that loosens their associative links sufficiently to enhance their creativity but not enough to make them mentally ill.

As in the first study, I've also found that creativity tends to run in families, and to take diverse forms. In this arena, nurture clearly plays a strong role. Half the subjects come from very high-achieving backgrounds, with at least one parent who has a doctoral degree. The majority grew up in an environment where learning and education were highly valued. This is how one person described his childhood:

Our family evenings—just everybody sitting around working. [redacted] all be in the same room, and [my mother] would be working on her papers, preparing her lesson plans, and my father had huge stacks of papers and

journals … This was before laptops, and so it was all paper-based. And [redacted] be sitting there with my homework, and my sisters are reading. And [redacted] just spend a few hours every night for 10 to 15 years—that's how it was. Just working together. No TV.

So why do these highly gifted people experience mental illness at a higher-than-average rate? Given that (as a group) their family members have higher rates than those that occur in the general population or in the matched comparison group, we must suspect that nature plays a role—that Francis Galton and others were right about the role of hereditary factors in people's predisposition to both creativity and mental illness. We can only speculate about what those factors might be, but there are some clues in how these people describe themselves and their lifestyles.

One possible contributory factor is a personality style shared by many of my creative subjects. These subjects are adventuresome and exploratory. They take risks. Particularly in science, the best work tends to occur in new frontiers. (As a popular saying among scientists goes: "When you work at the cutting edge, you are likely to bleed.") They have to confront doubt and rejection. And yet they have to persist in spite of that, because they believe strongly in the value of what they do. This can lead to psychic pain, which may manifest itself as depression or anxiety, or lead people to attempt to reduce their discomfort by turning to pain relievers such as alcohol.

I've been struck by how many of these people refer to their most creative ideas as "obvious." Since these ideas are almost always the opposite of obvious to other people, creative luminaries can face doubt and resistance when advocating for them. As one artist told me, "The funny thing about [one's own] talent is that you are blind to it. You just can't see what it is when you have it … When you have talent and see things in a particular way, you are amazed that other people can't see it." Persisting in the face of doubt or rejection, for artists or for scientists, can be a lonely path—one that may also partially explain why some of these people experience mental illness.

One interesting paradox that has emerged during conversations with subjects about their creative processes is that, though many of them suffer from mood and anxiety disorders, they associate their gifts with strong feelings of joy and excitement. "Doing good science is simply the most pleasurable thing anyone can do," one scientist told me. "It is like having

good sex. It excites you all over and makes you feel as if you are all-powerful and complete." This is reminiscent of what creative geniuses throughout history have said. For instance, here's Tchaikovsky, the composer, writing in the mid-19th century:

It would be vain to try to put into words that immeasurable sense of bliss which comes over me directly a new idea awakens in me and begins to assume a different form. I forget everything and behave like a madman. Everything within me starts pulsing and quivering; hardly have I begun the sketch ere one thought follows another.

Another of my subjects, a neuroscientist and an inventor, told me, "There is no greater joy that I have in my life than having an idea that's a good idea. At that moment it pops into my head, it is so deeply satisfying and rewarding … My nucleus accumbens is probably going nuts when it happens." (The nucleus accumbens, at the core of the brain's reward system, is activated by pleasure, whether it comes from eating good food or receiving money or taking euphoria-inducing drugs.)

As for how these ideas emerge, almost all of my subjects confirmed that when eureka moments occur, they tend to be precipitated by long periods of preparation and incubation, and to strike when the mind is relaxed—during that state we called REST. "A lot of it happens when you are doing one thing and you're not thinking about what your mind is doing," one of the artists in my study told me. "[redacted] either watching television, [redacted] reading a book, and I make a connection … It may have nothing to do with what I am doing, but somehow or other you see something or hear something or do something, and it pops that connection together."

Many subjects mentioned lighting on ideas while showering, driving, or exercising. One described a more unusual regimen involving an afternoon nap: "It's during this nap that I get a lot of my work done. I find that when the ideas come to me, they come as [redacted] falling asleep, they come as [redacted] waking up, they come if [redacted] sitting in the tub. I don't normally take baths … but sometimes I'll just go in there and have a think."

Some of the other most common findings my studies have suggested include:

Many creative people are autodidacts. They like to teach themselves, rather than be spoon-fed information or knowledge in standard educational settings. Famously, three Silicon Valley creative geniuses have been

college dropouts: Bill Gates, Steve Jobs, and Mark Zuckerberg. Steve Jobs —for many, the archetype of the creative person—popularized the motto "Think different." Because their thinking is different, my subjects often express the idea that standard ways of learning and teaching are not always helpful and may even be distracting, and that they prefer to learn on their own. Many of my subjects taught themselves to read before even starting school, and many have read widely throughout their lives. For example, in his article "On Proof and Progress in Mathematics," Bill Thurston wrote:
My mathematical education was rather independent and idiosyncratic, where for a number of years I learned things on my own, developing personal mental models for how to think about mathematics. This has often been a big advantage for me in thinking about mathematics, because it's easy to pick up later the standard mental models shared by groups of mathematicians.
This observation has important implications for the education of creatively gifted children. They need to be allowed and even encouraged to "think different." (Several subjects described to me how they would get in trouble in school for pointing out when their teachers said things that they knew to be wrong, such as when a second-grade teacher explained to one of my subjects that light and sound are both waves and travel at the same speed. The teacher did not appreciate being corrected.)
Many creative people are polymaths, as historic geniuses including Michelangelo and Leonardo da Vinci were. George Lucas was awarded not only the National Medal of Arts in 2012 but also the National Medal of Technology in 2004. Lucas's interests include anthropology, history, sociology, neuroscience, digital technology, architecture, and interior design. Another polymath, one of the scientists, described his love of literature:
I love words, and I love the rhythms and sounds of words … [As a young child] I very rapidly built up a huge storehouse of … Shakespearean sonnets, soliloquies, poems across the whole spectrum … When I got to college, I was open to many possible careers. I actually took a creative-writing course early. I strongly considered being a novelist or a writer or a poet, because I love words that much … [But for] the academics, it's not so much about the beauty of the words. So I found that dissatisfying, and I took some biology courses, some quantum courses. I really clicked with

biology. It seemed like a complex system that was tractable, beautiful, important. And so I chose biochemistry.

The arts and the sciences are seen as separate tracks, and students are encouraged to specialize in one or the other. If we wish to nurture creative students, this may be a serious error.

Creative people tend to be very persistent, even when confronted with skepticism or rejection. Asked what it takes to be a successful scientist, one replied:

Perseverance … In order to have that freedom to find things out, you have to have perseverance … The grant doesn't get funded, and the next day you get up, and you put the next foot in front, and you keep putting your foot in front … I still take things personally. I don't get a grant, and … [redacted] upset for days. And then I sit down and I write the grant again.

Do creative people simply have more ideas, and therefore differ from average people only in a quantitative way, or are they also qualitatively different? One subject, a neuroscientist and an inventor, addressed this question in an interesting way, conceptualizing the matter in terms of kites and strings:

In the [redacted] business, we kind of lump people into two categories: inventors and engineers. The inventor is the kite kind of person. They have a zillion ideas and they come up with great first prototypes. But generally an inventor … is not a tidy person. He sees the big picture and … [is] constantly lashing something together that doesn't really work. And then the engineers are the strings, the craftsmen [who pick out a good idea] and make it really practical. So, one is about a good idea, the other is about … making it practical.

Of course, having too many ideas can be dangerous. One subject, a scientist who happens to be both a kite and a string, described to me "a willingness to take an enormous risk with your whole heart and soul and mind on something where you know the impact—if it worked—would be utterly transformative." The if here is significant. Part of what comes with seeing connections no one else sees is that not all of these connections actually exist. "Everybody has crazy things they want to try," that same subject told me. "Part of creativity is picking the little bubbles that come up to your conscious mind, and picking which one to let grow and which

one to give access to more of your mind, and then have that translate into action."

In A Beautiful Mind, her biography of the mathematician John Nash, Sylvia Nasar describes a visit Nash received from a fellow mathematician while institutionalized at McLean Hospital. "How could you, a mathematician, a man devoted to reason and logical truth," the colleague asked, "believe that extraterrestrials are sending you messages? How could you believe that you are being recruited by aliens from outer space to save the world?" To which Nash replied: "Because the ideas I had about supernatural beings came to me the same way that my mathematical ideas did. So I took them seriously."

Some people see things others cannot, and they are right, and we call them creative geniuses. Some people see things others cannot, and they are wrong, and we call them mentally ill. And some people, like John Nash, are both.

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