AUTISTIC TRAITS AMONG ENGINEERS OF THE NUCLEAR INDUSTRY: PREVALENCE AND PROPENSITIES

A Thesis

by

SUZANNE BETH JOSEY

Submitted to the College of Graduate Studies of
Tarleton State University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Chair of Committee,	Stephanie Robertson, PhD
Committee Members,	Jonali Baruah. PhD
	David Deviney, PhD
Head of Department,	Thomas Faulkenberry, PhD
Acting Graduate Dean,	Nathan Heller, PhD

August 2022

Major Subject: Applied Psychology

Acknowledgements

Thank you, Dad, for being a good prototype. Thank you, Mom, for loving us anyway. Thank you, Abigail Sunshine, for attempting an edit. Sorry. Liam Einstein, Israel Newton, and Elizabeth Love, I know you can, too. Thank you, Jeff, for being such a good nuclear engineer and inspiring me with evidence of autistic traits on Zoom calls during the pandemic while the first thesis idea fell apart. Thank you, Father, for giving me strength. Committee, you are clearly patient and kind people to willingly walk beside me through this thesis.

Abstract

Josey, Suzanne, Autistic Traits Among Engineers of the Nuclear Industry: Prevalence and Propensities, MASTER OF SCIENCE (Applied Psychology), August, 2022, 96 pp., 15 tables, 4 figures, bibliography, 172 titles.

The prevalence of autistic traits among engineers of the nuclear industry is unknown. Evidence suggests elevated autistic traits are common among engineers and other science, technology, and math fields, thus elevated traits were anticipated among nuclear engineers as well. To assess autistic traits, a survey comprised of limited questions from the Autism-Spectrum Quotient and other questions about autistic propensities was created in Qualtrics. The survey was distributed primarily through targeted social media groups and email. Results indicate a prevalence of elevated autistic traits among nuclear engineers that is in line with other STEM respondents in this study. Engineers of the nuclear industry showed significantly higher rates of offspring diagnosed with autism. Veterans were overrepresented in the sample and showed significantly elevated autistic traits as well. Elevated autistic traits had no impact on religious attendance, number of times a person socialized with coworkers outside of work, or the accuracy or timing of completing a syllogism, but were related to higher indicated perceived identity as a stereotypical engineer and lower enjoyment of coworkers. Nuclear industry employers should have practices that are best suited for their employees and their employees' families.

TABLE OF CONTENTS

LIST OF GRAPHICS

TABLE **Page**

FIGURE **Page**

Autistic Traits Among Engineers of the Nuclear Industry:

Prevalence and Propensities

When Plato established Akademia, the first university, lore tells us he hung a plaque at the door requesting no non-geometers enter (Bernard, 2011): Your ability to do the most sophisticated math of the time was your only ticket in. In the Vonnegut (1952) novel, Player Piano, one of the main character engineers, sitting at the bar with the priest, coarsely describes his frustration with the people as he says if it weren't for the people, the Earth would be an engineer's paradise. If a person were to google the term engineer's syndrome today, the person would find a definition describing an aloof, socially inhibited, data-loving person driven by information more than human relationship. Terms like geek syndrome and engineer's disease have been used for decades to describe the undiagnosed with elevated traits of autism without intellectual disability (Davenport, 2016; Silberman, 2001), and a few studies suggest the name is well-earned (Baron-Cohen et al., 1997; Baron-Cohen et al., 1998; Baron-Cohen et al., 2001; Baron-Cohen, 2006; Crespi, 2016; Jarrold & Roth, 1998; Wheelwright & Baron-Cohen, 2001). This stereotypical engineer aligns well with a person who is high in autistic traits as measured by the Autism Spectrum Quotient (AQ, Baron-Cohen et al, 2001) or the Broader Autism Phenotype Questionnaire (BAPQ) as defined by Hurley et al. (2007). Because colloquial use of engineer's syndrome definition so closely aligns with these measures of subclinical autistic traits, one could assume there is a prevalence of engineers with subclinical traits of autism within any engineering industry including the nuclear industry. If so, we may see evidence of the traits within their quantity of social interactions with coworkers,

enjoyment of coworkers, syllogistic skills, narrative descriptions of manger performance, and by direct measure using select questions form the Autism-Spectrum Quotient (AQ) (Baron-Cohen, 2001).

Nuclear

Nuclear power production is a niche market requiring expert employees. Since an association of autism and engineering is previously established (Baron-Cohen et al. 1997; Baron-Cohen et al. 1998b; Jarrold & Roth, 1998) and the subfield of nuclear engineers seems unresearched from the perspective of autistic traits, some effort will be expended describing the basic science, history and scientists, and industry.

Nuclear Power Basics

Nuclear power generation in the world today is a safe, efficient means of producing power (Spradley, 2019). Nuclear power plants produce approximately 10% of the world's electricity consumption needs (World Nuclear Association, 2022). About one fifth of America's power comes from nuclear plants (Nuclear Regulatory Commission (NRC), 2020d; Spradley, 2019). Approximately 440 commercial nuclear power plants are operating worldwide currently, 93 are in the United States (World Nuclear Association, 2022). Nuclear power generation is important as a low quantity pollution supplement to coal and gas power generation (Spradley, 2019). Nuclear power reliably provides 52% of the non-greenhouse gas emitting energy in the US, running at full capacity more than 90% of the 2020 year (Department of Energy Office of Nuclear Energy (DOEONE), 2021). It's efficiency far exceeds other clean energy sources. All of the spent fuel produced in the entire commercial nuclear history could fit on one football field, less than

10 yards deep (DOEONE, 2021). Uses of nuclear power extend beyond electricity generation and include space exploration, disease transmission control, and medical applications for diagnosis and treatment (World Nuclear Association, 2022).

In most commercial power plants, electricity from nuclear power is produced by generating steam (Nuclear Regulatory Commission (NRC), 2020d) like an old-fashioned steam engine. Heat produced by fission heats water and makes steam, which then causes a turbine to spin a generator, thereby producing electricity that is sent to the grid. (NRC, 2020d). The water that is heated is contained separate from the water that evaporates and is released as steam above the parabolic cooling towers (NRC, 2020d). The cooling tower is essentially making clouds. Coal, oil, or gas is used at other common types of power plants to heat water in a similar system (Department of Energy (DOE), 1994). Greater use of nuclear power would help us achieve the white house goal of reduced emissions. Fission is the process of splitting the nucleus of an atom (DOE, 1994). When neutrons are released from the splitting of one nucleus they hit other atoms, and it causes a series of nuclei to split: That is a chain reaction, and it generates substantial heat (DOE, 1994; NRC, 2020e). Uranium and plutonium are both natural sources of radioactive, fissionable material (NRC, 2020e). A certain isotope of uranium, U235, is the most common source of fission used in American nuclear power (Spradley, 2019). These elements are enriched to be used as nuclear fuel (NRC, 2020e). Plutonium is used in space travel, weapons, and a few foreign power plants (NRC, 2020f). Fusion is joining atoms to produce energy (DOE, 1994): Several labs are working to develop fusion reactors for energy production.

History of Nuclear Power and Scientists

The discovery of the fission process involved a series of scientists. The term atom is derived from the Greek word ἄτομος, reflecting the idea that uncuttable particles must exist composing all matter (DOE, 1994). Einstein stood on the shoulders of a few giants in 1905 when he developed the formula $E=mc^2$ suggesting there was a relationship between matter and energy (DOE, 1994).

Niels Bohr is the man who gave us the solar system-like model of the atom (DOE, 1994; NRC, n.d.). He and Einstein debated the nature of electrons and other issues of quantum physics (Kaiser, 1994). Evaluation of the Einstein-Bohr debates demonstrates evidence of autistic traits one may see as being phenotypical in both men. Each man regarded the other as too dogmatic to hear a new thought; they were aloof, rigid thinkers. Bohr had a proclivity for "obscure language" (Kaiser, 1994, p132), demonstrating pragmatic language irregularity. In part their differences seemed to arise because Bohr is said to have thought in words where Einstein is said to have thought in pictures (Kaiser, 1994). Robert Crease and Charles Mann (as cited in Kaiser, 1994) titled their chapter on Bohr "The Man Who Talked," noting that his language was extraordinarily meticulous; he even made rough drafts of notecards before writing. In contrast, Einstein's three major papers were quite brief with no flourish (Kaiser, 1994).

Enrico Fermi, an Italian physicist who later naturalized in America, built the first nuclear reactor under an athletic field at the University of Chicago in 1942 (DOE, 1994). Fermi once commented on Einstein's formula that he pitied the first man to find a way to release that energy because he would probably be smashed to pieces, and yet, demonstrating a low respect for danger, Fermi later did it anyway (Bernardidni, &

Bonolis, 2001). Lise Meitner used Einstein's formula to explain why there was less mass than anticipated after Hahn and Strassman fired radium and beryllium into uranium leaving barium, a lighter element, behind: In doing so she validated Einstein's theory and proved that fission had occurred and release energy (DOE, 1994). Meitner, Hahn, and Strassman were all based in Germany (Atomic Heritage Foundation, 2017). Einstein wrote President Roosevelt encouraging him to hasten the project because he feared Germans were developing the technology (Atomic Heritage Foundation, 2017).

Many of the Manhattan Project leaders were immigrants, but Einstein was not allowed to work on the project because he failed security checks. Fermi participated in the Manhattan Project, the secret program that developed nuclear weapons used during World War II (DOE, 1994). He also built the first nuclear reactor. Like psychology and other sciences, nuclear physics benefited from the influx of talent into the United States caused by the World Wars.

The development of nuclear weapons preceded the development of peaceful uses of nuclear power (DOE, 1994). Robert Oppenheimer was a theoretical physicist and the progenitor of the nuclear weapons used on Hiroshima and Nagasaki (Cassidy, 2005; Smith & Weiner, 1995). Little Boy landed on Hiroshima; it was a uranium bomb that decimated about 5 square miles. Fat Man landed on Nagasaki; it was a plutonium bomb that decimated about 3 square miles.

Oppenheimer is said to have claimed that he needed physics more than friends (Cassidy, 2005). Classmates wanted him removed because he bogarted the class discussions (Smith & Weiner, 1995). He had an antagonistic relationship with his tutor in lab (Smith & Weiner, 1995). His lab tutor declared him to be too clumsy in the lab to be

an applied physicist (Smith & Weiner, 1995). These behaviors would be characteristic of someone demonstrating autistic traits (APA, 2013, Baron-Cohen, 2001).

After the war ended, nuclear power was employed to power submarines and ships of the U. S. Navy. Admiral Hyman Rickover, the father of the nuclear Navy, described himself as having the charisma of a chipmunk (CBS, 1984). He had the tongue in cheek nickname of the Kindly Old Gentleman, KOG. During his 63-year military career he managed the development of the nuclear navy propulsion system (Duncan, 1990). He had a monomaniacal obsession with safety (Duncan, 1990). In the *Economics of Defense Policy* presented to the 97th Congress Rickover demanded extraordinary training requirements using active reactors so that they could "concentrate on designing, building, and operating the plants so as to prevent accidents, not just cope with accidents that could occur" (as cited in Duncan, 1990, p. 296). In an interview (CBS, 1984) with Diane Sawyer, he told her, "I never thought I was smart. I thought the people I dealt with were dumb, including you." He rebuffed traditional military salutes. It is noteworthy that in the photographs of Rickover found throughout his biography he rarely reciprocates the positive emotions displayed by others also in the photographs (Duncan, 1990). He was something of a hobby psychologist, always testing how people would react to stressful situations to determine if they were fit for his program: He put sailors in the broom closet for hours if they gave him what he thought were dumb answers so that they could have time to think, and he chopped off the front legs of chairs an interviewee had to sit in to disorient him while he was interviewing them for a position (CBS, 1990). His career ended when he upset key men at General Dynamics by exposing fraud (CBS, 1984). It is hard to imagine Rickover would have had similar career success in a modern world that

places so much more value on emotional intelligence, yet the value of his obsessiveness for safety and cool-headed workers proved beneficial to the success of the nuclear Navy program (Duncan, 1990). There were no nuclear accidents under his headship (Duncan, 1990).

Nuclear Power Employees

The talent pipeline from Navy nuclear program to nuclear industry continuously flows; veterans make up 21% of the nuclear utility workforce (Kakridas, 2020) compared to 7% of the general population (U. S. Census Bureau, 2021). There are few universities that continue to offer a nuclear engineering degree, only 14 based on simple internet search.

An estimated 15,700 nuclear engineers are employed in the United States (U.S. Bureau of Labor and Statistics (BLS), 2021). Nuclear engineers might be employed at nuclear power plants, nuclear research laboratories, government agencies that regulate nuclear power and medical radiation, or medical facilities (BLS, 2021). Engineers that work in the nuclear industry may have other engineering degrees, such as mechanical, electrical, chemical, or general (The Virtual Nuclear Tourist, 2010).

The number of nuclear power generation workers peaked in the 1990s and have slowly dwindled as plants have begun to close (BLS, 2021). Job security for nuclear employees has been impacted by the reduction of plants (Ailworth, 2018; BLS, 2021). From 2020 to 2030 and additional 8% decrease in jobs is anticipated (BLS, 2021). The workforce for the industry is aging. An estimated 64% of the Nuclear Regulatory Commission is retirement eligible currently. Political policy and public opinion wax and wane impacting interest in careers.

Nuclear power's primary struggles have often been sociological in nature (Verma, 2021). In the latter part of the twentieth century, following the Three Mile Island (TMI) accident in 1979, the sociological fallout was fear and mistrust from the public (Verma, 2021) leading to the development of citizen protest groups (Walsh, 1981). Prior to TMI, the NRC had an aversion to regulating people and considered that to be the responsibility of management (Verma, 2021; Wellock, 2021). Post TMI, behavioral experts were employed by the NRC to evaluate organizational culture despite resistance from industry (Verna, 2021). Eventually the program evolved to evaluate plant performance indicators instead of direct assessment after the mid-nineties (Wellock, 2021). Each time a news-worthy event happens at a nuclear plant the industry takes a hit and engineering employees are reduced then it takes a few years to recover (BLS, 2021): TMI in 1979, Davis-Besse in 2002, and Fukushima in 2011 (Kitada, 2016).

Little et al. (2013) found that human health has not been substantially impacted intergenerationally by exposure to ionizing radiation from radiotherapy or the atomic bombs used in Japan. All of that to say, the rate of radiation exposure for a typical nuke worker is very slow and is not being implicated as causal for autism in this investigation. Nuclear workers who are regularly exposed to low levels of radiation as defined by the Standards of Protection Against Radiation (1991) have shown no adverse biological effects. (NRC, 2020b).

Since human and organizational failures are contributors to every non-natural nuclear event (Verma, 2021), it behooves the industry to thoroughly understand and

manage the individual workers and the work culture. To be able to do this well, an investigation into autistic traits of engineers is warranted.

Career

Career Theory

Admiral Hyman Rickover said he was interested in becoming a nuclear engineer to avoid the salutes and greetings required in the military, he thought any mannequin could do that, and because he wanted to be able to access the belly of the machine (CBS, 1984). Reasons other than avoiding awkward social greetings drive most career decisions. There are five common career theories and other culture-specific models that explain the phenomenon of career development (Leung, 2008). They are the Theory of Vocational Personalities in Work Environment, the Self-concept Theory of Career Development, Gottfredson's Theory of Circumscription and Compromise, Social Cognitive Career Theory, and Theory of Work-Adjustment. All models imply a formulaic fit between person and work environment due to respective traits (Leung, 2008). Though they have different metrics they build on, be it personality, maturity, or identity, they are unified in a theme of measurable compatibility or predictability (Leung, 2008).

Holland's Theory of Vocational Personalities in the Work Environment asserts that vocational interest is an expression of personality (Holland & Gottfredson, 1976; (Holland, 1996; Leung, 2008). He posits six categories of both personality and profession: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (Holland & Gottfredson, 1976; Holland, 1996). This model is referred to by the acronym RIASEC (Holland, 1996). The construct of the RAISEC is described as

hexagonal in structure with neighboring categories being similar and categories on the opposite side structure being dissimilar (Holland, 1996); this is similar to the function of a color wheel. Personalities or careers could be described with both a primary as well as secondary and tertiary categories. The primary categories most relative to the current investigation are Realistic and Investigative because nuclear power generation is a synthesis of engineering and physics. According to the National Center for O*Net Development (NCOD, 2021), nuclear engineers are IRC careers. Other IRC careers include chemists, biomedical engineers, robotic engineers, mechanical engineers, and petroleum engineers as well as others (NCOD, 2021). Holland (1996) describes attributes of Realists as identifying as lacking social skills, seen by others as frank, avoiding interaction with people, and possessing mechanical skills. He describes Investigative personalities as seen by others as asocial and intellectual, self-identifying as lacking interpersonal skills, and preferring activities such as exploring prediction or control of natural or social phenomena. Lorenz and Heinitz (2014) interviewed 136 workers with Asperger's syndrome and found a concentration in Investigative, Realist, and Conventional careers, even with a higher than typical female sample.

At the inception of autism, some of Kanner's charges were children of fellow psychologists (Kanner, 1943). Holland (1996) also classifies psychologists as Investigative careers. If we consistently expect psychologists to possess these personality traits, and personality is heritable (Power & Pluess, 2015), we should not be surprised that the children of psychologists were among the first identified as autistic at its inception.

Development of Identity for Nuclear Engineers

Nuclear engineers have been described by Professor Sean Johnston (2012) of the University of Glasgow in his book *The Neutron's Children: Nuclear Engineers and the shaping of Identity* as suffering from, "arrested development, weak communication skills, a poor socialization" (Wolfe, 2013, p. 48). Johnston's framework for professional identity aligns with sociologist Andrew Abbott's Theory of Professions (Wolfe, 2013). There is a tension between prestige and efficiency (Wolfe, 2013). The challenge for nuclear engineers in the prior century was honing an identity of new a discipline in a new industry with a new technology, and in the earlier part of the century, it involved secrecy and isolation (Wolfe, 2013). Sociological struggles, following highly publicized accidents, impacted engineer identity development (Wolfe, 2013).

Influence of Military

As previously mentioned, the Navy nuclear propulsion program is a feeder for the nuclear industry workforce (Kakridas, 2020). Since the early 70s the military has been an all-volunteer organization (Stacy, 2020). Since the elimination of the draft, recruits have freedom to join the military or not; motivation has changed (Elder et al., 2010). In this volunteer period, young adults are motivated to join by social and economic factors (Elder et al., 2010). The military offers social support and comradery that may be lacking at home; adults who join the military instead of going to college right out of high school are more likely to have single parent homes and report low social support (Elder et al., 2010). The appeal of the military may be stability and relationships to those who are not well integrated into society or who lack personal self-control (Elder et al., 2010). Young

adults are more likely to join the military if they have a history of behavioral problems. The military only permits admission to those diagnosed with autism via waiver if their symptom can be managed without medication currently, which is ironic because there are no medications for the core diagnostic criteria of autism, only comorbid conditions (Alli, 2020). Undiagnosed people with social and behavioral problems are not forbidden and it is unknown how representative they are of what Elder et al. described in his findings.

The military was the first to use widespread psychometric testing for the purpose of assessing cognitive abilities for potential placement of roles (Kevles, 1968). The Armed Services Vocational Aptitude Battery (ASVAB) has been used by the military since 1968 (Stacy, 2020). The ASVAB is used to determine a recruit's aptitude for specific roles within the military (Stacy, 2020). Certain scores are required for specific positions. To enter the Navy nuclear program, you must score a minimum of 252 on four combined portions and then pass the Navy Advanced Programs Test (Goering, 2012). This is the highest required score for any position: In comparison, a Hospital Corpsman needs a 209 and an Intelligence Specialist needs a 215 (Goering, 2021). Per Naval Sea Systems Command (n.d.), the navy nuclear power school is the most academically rigorous program in the military.

Intelligence and Career

Intelligence is an ephemeral concept; it is very had to define. Intelligence has waxed and waned in popularity as a research topic (Hauser, 2002). It was the original nature of the work done by Kanner (1949) and Asperger (1991). In essence, it was the foundational psychometric tool for all of psychology, including pediatrics (Anunciação, 2018). It did not take long for the test of intelligence to reveal its potential for applied

judgement. Scores were dubiously used for eugenics purposes and revealed to be racially and ethnically biased (Hauser, 2012). Intelligence tests are still frequently used for diagnostic work today, but less often as a research topic (Hauser, 2012). It is important to keep in mind that intelligence test results are more like a snapshot than a crystal ball: They focus on the select skill they are designed to assess and do not necessarily determine the future.

Even though intelligence tests have their limits, we can see associations between scores and vocations (Hauser, 2002). Intelligence tests can predict academic success, and academic success can predict job opportunities (Hauser, 2002). General cognitive ability has been shown to be a central determinant in the effectiveness for engineers and other professional roles (Pons, 2015). Hoekstra et al., (2011) describe one of the traits identified by the short version of the AQ as fascination with numbers and patterns, which makes it make sense that we see higher rates of autistic traits in engineers and other math and sciences. It *may* also explain how a person would score higher on IQ tests that assess for patterns and number recall. In the multi-decade study done by Hauser (2002), consistently the occupations with the higher soring IQ were those of engineering, science, college educators, and medicine. It is worth noting that the top scoring janitors outscored the lowest scoring doctors, being on opposite ends of the IQ medians (Hauser, 2002): IQ is certainly not destiny. IQ, along with social influences and educational attainment, can be associated with occupational success (Hauser, 2012).

Soft Skills and Tech Industries

The workforce has changed for engineers over the last several decades: There has been a shift from an individual contributor role to a more interactive, collaborative role

(Joyner et al., 2012). Trade-specific skills and intelligence alone are inadequate for success in the modern world: There is need for soft skill training to improve the uniquely human abilities of negotiation, communication, and teamwork (Börner et al., 2018; Boyatzis et al., 2012; Changkajonsakdi & Kaewkuekool, 2019). The traits identified as soft skills are self-awareness, self-regulation, motivation, empathy, and social skills (Goleman, 1996; Newell, 2002). Each of those could be specific deficits of those who are very high in autistic traits (Baron-Cohen et al., 2001; Ingersoll et al., 2011). Alexithymic traits that are characteristic of people high in autistic traits would certainly impede self-awareness and impact social intelligence (Mason & Happé, 2022). Börner et al. (2018) found greater need for soft skill training in very technical fields. Lacking emotional intelligence may reduce the likelihood of advancement in the workplace (Newell, 2002). In contrast, tough skills were defined by Goleman (1996) as intelligence, analytical/technical, determination, rigor, and vison. Cognitive intelligence, as opposed to emotional intelligence, is crucial but not a complete fulfillment of the requirements for the modern task of engineering (Boyatzis et al., 2012).

Emotional and social intelligence as perceived by coworkers predicts career success in engineers even though personality and general intelligence did not (Boyatzis et al., 2017). Interestingly, Boyatzis et al. (2017) found a negative correlation between general cognitive ability and tenure. One possibility for an explanation presented by Boyatzis et al. (2017) was that the smartest might be inclined to accidentally offend or not emotionally connect with his coworkers, leading them to avoid his/her ideas. Newell (2002) found that often smart, technical employees are initially aversive to feedback. On a positive note, soft skills are learnable by academic means such as training and coaching

when they are not intuitive (Boyatzis et al., 2012; Jennings, 2021) once the worker is receptive (Newell, 2002).

Issues of Leadership

Engineers can be reluctant to accept leadership positions (Rottman et al., 2015). This is in part due to their lack of appreciation for the soft skill nature of the work: In the minds of engineers, real work involves doing and not delegating (Jennings, 2021). They prefer to work within their comfort zone, have tangible immediate results, and to follow specific rules as opposed to nuanced best practices (Jennings, 2021). The nuanced nature of leadership responsibilities can be challenging (Jennings, 2021). Rottman (2015) suggests engineers can be compelled into leadership roles by using terms like team lead instead of manager because it gives the impression of continuation of valued work. Even when an engineer has emotional intelligence, it is possible for them to struggle in their leadership role if they lack interest in managing relationships (Jennings, 2021). It is also characteristic of people high in autistic traits to lack motivation to complete tasks well that are outside of their interests (Jordan & Caldwell-Harris, 2012).

Significance of safety culture within the nuclear industry justifies better identification of thinking habits of engineers and decision makers within the industry. The International Atomic Energy Agency (IAEA, 2013) suggested that 80% of the significant adverse events in the nuclear industry are effects of human error. Most of these errors, approximately 70%, are attributable to organizational weakness (IAEA, 2013). These organizational weaknesses are reflections of underdeveloped soft skills on the part of organizational management (Jennings, 2021). A mere 30% of the human errors causing adverse events are individual mistakes (IAEA, 2013).

Over the last several decades there has been a shift in ethics training to reduce the legalistic tradition of ethics and make room for a moralistic grey space, virtue ethics (Furey, 2017). This newer approach to ethics requires greater cognitive flexibility. Furrey (2017) raises concern that it may be an impediment to the disproportionately high percent of engineers in the industry. When ethics are based on consequentialism instead of deontology it introduces subjectivity into the system, which may not be ideal for this population (Furrey, 2017). With the growth of interest in Science, Technology, Engineering, and Math (STEM) comes a need for STEM training that can reach the STEM-inclined with their unique ways of thinking (Ehsan et al., 2018). Virtue ethics are built on concepts of excellence and fulfillment that are hard to establish concrete meanings, increasing communication difficulties when negotiation is necessary (Furrey, 2017). Difficulties with pragmatic language usage have been demonstrated to impede adjustment for college students with elevated autistic traits (Trevisan & Birmingham, 2015): It would be worth investigating to see if this carries into the workforce for engineers. If so, it may be safer for engineers to stick to the traditional rule-based ethics (Furrey, 2017).

As mentioned above, smart employees can be reluctant to negative feedback (Newell, 2002), but processing the feedback is necessary for growth (Jennings, 2021; Newell, 2002). Jennings (2021) proposes a standardization of the promotion to management process for nuclear engineers across the commercial industry. She suggests including soft skill feedback from earlier in the career before management positions are an option and providing leadership training from the intro level up. That should produce a

better performing organization with a larger potential management pool to choose from when the need arises.

Careers in nuclear power demand certain skills from a person. The person who is inclined to choose a career in nuclear power is likely to demonstrate traits of cognitive intelligence, possibly reduced social and emotional intelligence, and inclined to realistic, investigative, and conventional interests. These traits overlap autism in several ways.

Autism

Autism was not added to the DSM (APA, 1980) until after many nuclear engineers were born. Per *Nuclear engineer demographics and statistics in the US* (2021), the average age of a nuclear engineer is 43.1 years based on a Zippia survey. Respondents showed concentration in military base locations suggesting many participants were probably young sailors identifying as nuclear engineers, and this may skew the data. In contrast, a substantial percent of the NRC workforce is retirement eligible currently. Even if the nuclear engineers met the diagnostic criteria for autism during their childhood, it is extremely unlikely that they would have been diagnosed considering the lack of practitioner familiarity and appropriate diagnostic tools for an intellectually intact population. This suggests etiology and history of autism be considered when investigating the population.

Autism History

Leo Kanner is often attributed with coining the term autism (Kanner, 1943). Hans Asperger is said to have also used the term to describe his *little professors* in Austria shortly before Kanner (Baron-Cohen, 2015). A Russian Jewish woman named Grunya Efimovna Sukhareva described a very similar condition in her patients in the 1925,

originally calling it schizoid and later autistic psychopathology (Manouilenki & Bejerot, 2015). Kanner's first use of the term autism falls about halfway between the development of metrics of intelligence (Anunciação, 2018) and the admission of the term autism in the DSM (APA, 1980), and another forty years has passed since then.

Kanner (1943) observed a young boy named Donald that had distinct intellectual abilities, inappropriate behavior, and lacked apparent desire for human interaction. Kanner (1949) had experience researching feeblemindedness, the term of the time for intellectual impairment, and intended his research to be used for eugenics purposes that he referred to as human engineering. Donald's presentation was distinct from feeblemindedness, yet there were similarities primarily relating to behaviors (Kanner, 1943). Several other children were brought before Kanner that resembled Donald, often via correspondence. Parents of these charges were usually highly educated professionals, some peers of Kanner, often lacking apparent desire for sincere relationships themselves. One father was described as aloof, a key term to describe the BAP (Piven et al., 1997), and rude to his wife who was described as a rather educated and sophisticated woman (Kanner, 1943).

Over time, an association with intellectual disability has become stronger with the diagnosis of autism (Hens, 2021). Some blame this shift on diagnostic substitution where a more palatable diagnosis or a diagnosis that provides more services is given instead of a diagnosis with less hope or fewer services associated (Hens, 2021). Whole books have been written about the surprising transition from Kanner's smart, peculiar loner being identified as autistic to the modern societal expectation of intellectually challenged school child donning the same label (Waterhouse, 2013).

The term autism was not added to the DSM until the third edition, about four decades after the Kanner (1943) paper (APA, 1980; Rosen et al., 2021) in the year of Kanner's death. It was labeled as Infantile Autism and made distinct from Childhood Schizophrenia by eliminating psychotic features and including self-mutilation (APA, 1980; Volkmar et al., 1986). The population the standards were developed on had an average IQ of 33 (Volkmar et al., 1986). Halfway between the development of the term autism and modern day came the development of the gold standard for diagnosis of autism, Autism Diagnostic Observation Schedule (ADOS, Lord et al., 1989). Because nuclear engineers reflect an aging population that would not have had the opportunity to be diagnosed in childhood due to criteria that would not have met their presentation, we may see elevated traits in our sample.

Current Autism of the DSM

Autism is a neurodevelopmental condition: Diagnostic criteria include persistent deficits in social communication and social interaction across multiple contexts and restricted, repetitive patterns of behavior, interests, or activities (APA, 2013). When the diagnostic criteria changed in 2013 it complicated the contemporary research of autism and similar disorders (Posar et al., 2015). Prior to the change, Asperger's Syndrome was similar to what is colloquially described as high functioning autism but excluded the possibility of comorbid intellectual disability (APA, 2000). Autism was a separate diagnosis from Asperger's (APA, 2000). When a search is performed on the term autism it is important to be mindful of the etiology of the term and the appearance and disappearance of variations of the autism spectrum disorder over time.

Autism is thought to be highly heritable (Bulik-Sullivan et al., 2015; Clarke et al., 2016; Sasson et al, 2013), but environmental effects contribute substantially, as much as 40-50% (Modabbernia et al., 2017). Modest advances have been made in identifying some potential genetic information causing autism (An et al., 2019; Yuen et al., 2017). Males are diagnosed four times more often than females, suggesting many autistic females remain undiagnosed (APA, 2013; Boorse et al., 2019; Dworzynski, et al., 2012; Milner et al., 2019; Loomes, et al., 2017; Parish-Morris et al., 2017; Rosen et al., 2021), even when girls are equally symptomatic (Loomes, et al., 2017; Parish-Morris et al., 2017), especially females without intellectual impairment (APA, 2013). Alvares et al. (2020) argues for the elimination of the term high functioning to describe autistic people who are intellectually intact because autism shows greater impact on adaptive functioning to that group compared to their non-autistic, IQ-matched peers.

Broad Autism Phenotype

For over 20 years the term Broad Autism Phenotype or Broader Autism Phenotype (BAP) has been used to describe the family members of autistic probands, patient zero or person at the starting point of a study, displaying subtle autistic traits (Berthoz et al., 2013; Hurley et al., 2007; Kulasinghe et al., 2021; Piven et al., 1997; Rubenstein & Chawla, 2018; Ruzich et al., 2015; Trevis et al., 2020). Men, but not women, who display traits of the BAP have been reported to fail at self-identifying those traits (Rubenstein & Chawla, 2018; Sasson et al., 2014). Self-report may be influenced by BAP traits (Bishop et al., 2004; Sasson et al., 2014). BAP traits in mothers increased the discrepancy between observer and mother report of autistic traits in children (Rubenstein

et al., 2017). Trevis et al. (2020) found that 76% of the family members of an autistic proband were likely to meet criteria for BAP if they were not diagnosed with ASD.

Sometimes the line between the end of diagnosable autism and the presence of autistic personality traits is indistinct (Asperger's syndrome, 2014). The BAP is like autism because we can sense impairment in predictable ways that resemble classic autism. The BAP is not autism because the impairment does not meet the true threshold for diagnosis. Autism is a normal part of the manifestation of humanity, anyone could have subtle traits; it's a spectrum. And some people will have more traits than others but still not meet the threshold for diagnosis. The gray space can be investigated using the AQ. Because engineer syndrome so closely resembles the gray space between autism and the general population, we expect to see elevated AQ scores in our sample.

Comparison of BAP and Autistic Traits

An individual displaying traits of the BAP may have atypical pragmatic language usage, behavioral or cognitive inflexibility that makes them seem rigid, and atypical social interaction or cognition that makes them seem aloof (Hurley et al., 2007, Bishop et al., 2004, Piven et al., 1997). The five domains assessed by the AQ are communication, social, imagination, local details, and attention switching. When research has been done on families with an autistic proband there is preference for the term BAP, hence the term phenotype being borrowed from biology (Piven & Sasson, 2014). Where research has been done on the general population there is preference for the term autistic traits usually relative to some other measure. Obviously, a person does not have to have a child diagnosed with autism to have traits, but many people with a child with autism display traits (Berthoz et al., 2013; Hurley et al., 2007; Kulasinghe et al., 2021; Piven et al., 1997;

Piven & Sasson, 2014; Rubenstien & Chawla, 2018; Trevis et al., 2020). Both terms are referenced herein to refer to those with subclinical traits of autism while acknowledging that multiple tests exist measuring traits but not rendering diagnosis. Baron-Cohen et al. (2001) considered BAP and AT to be one in the same within the discussion preceding AQ development. If someone indicates on the survey that they have a family member with autism there may also be elevated AQ scores.

Testing

Autism Diagnostic Observation Schedule (Lord et al., 1989) is the gold standard assessment for diagnosing autism. It was the first tool of its kind to standardize the observable social and communicative autistic traits for the diagnostician. It was developed on a low IQ (m=59) and average IQ (m=95) pediatric population back when the diagnosis was fresh in the DSM. ADOS uses measures of self-report when possible, diagnostician report, and an additional input from educators and/or parents. The assessment is play-based so that the observer can witness behaviors firsthand (Lord et al., 1989).

An observer rating scale evaluation is subject to subjectivity (Zhao et al., 2020), even though 80-90% concordance is required before a practitioner is considered trained. Other methods of diagnosis that are less abstract have been deemed desirable (Zhao et al., 2020). Zhao et al. (2020) found a 92.7% accuracy rating in identifying cases of ASD using and EEG to assess alpha wave heart rhythms. Araujo et al. (2019) observed differences in endocannabinoid levels that might be useful for diagnostics. Rensselaer Polytechnic Institute (2018), home of the Engineers sports teams and one of the few schools where nuclear engineering is available as a degree, developed a blood test based

on various metabolites for detection of autism. Many studies have been done on potential genetic markers for identification (Bulik-Sullivan et al., 2015; Nishiyama et al., 2009; Shindler et al., 2020; Yuen et al., 2017).

People who received a diagnosis of Asperger's as adults often described both an awareness of their struggle prior to diagnosis and a confusion about the nature of the struggle (Punshon et al., 2009). There is some insight but not enough insight to create an answer or solution. Lack of insight is characteristic of people high in autistic traits (Jia et al., 2019; Sasson et al., 2014). Observing this lack of insight in the presence of a group of people stereotyped for their traits that resemble autism is like looking at Schrödinger's box: There is no way to know exactly what is inside without peeking in. Often people who receive a diagnosis of autism in adolescence or adulthood have received other diagnoses prior to autism (Hickey et al., 2017; Punshon et al., 2009). Adults experience a misdiagnosis due to shifting diagnostic criteria and changing practices (Lai & Baron-Cohen, 2015; Posar et al., 2015; Regan, 2021). Another consideration is that neurotypical people, people who are not neurologically atypical in autistic ways, also have trouble reading the expressions of those with elevated autistic traits, which compounds the complications of communications and assessment (Bishop & Seltzer, 2012; Jai et al., 2019; Milton, 2012) since most diagnosticians are probably neurotypical. Communication is likely easier for two people who think the same way. Within self-report measures, it is possible that the lack of insight biases the responses of those truly possessing autistic traits toward a neurotypical response (Bishop & Seltzer, 2012; Jia et al., 2019).

Testing of true autism or autistic traits in a population is very complicated. The tools are imperfect. The assessor and the assessee are both human and inclined to bias or subjectivity. Likert scales provide a false sense of numericity: one person's 2 is another person's 7. For this reason, a few questions are added to the survey, one timed syllogism, one quantifying religious habits, and one quantifying social habits, to function as validity indicators and to give quantitative information to the self-descriptive AQ score. Each question has research backing an association with elevated autistic traits.

Prevalence

Autistic traits range across the general population from minimal to severely impaired (Constantino & Todd, 2003). As a normal bell curve suggests, there are very few people with almost no traits and very few people with severely life-limiting traits: Most people fall within the peak of the bell when the AQ is administered (Baron-Cohen et al., 2001; Ruzich et al., 2015). Those on the very low end of scores probably self-identify as extroverts with agreeable tendencies (Ingersoll et al., 2011; Lodi-Smith et al., 2018). Those ranking very high scores probably meet the diagnostic criteria for autism (Barron-Cohen et al., 2001). However, people who are very high in autistic traits may lack insight necessary to identify as high in autistic traits, especially men (Sasson et al., 2014). Being high in autistic traits is a latent construct that is attempting to quantify a sub-clinical condition of personality and is inherently difficult to measure, whether by self-report or observer-report (Rubenstein & Chawla, 2018).

During the writing of this proposal the Center for Disease Control (CDC) published data suggesting the prevalence of autism increased from one in 54 to one in 44 eight-year-olds based on data collected in 2016 and 2018 respectively (Maenner et al.,

2021). The CDC suggests the increase is attributed to better diagnosis practices among minority groups. The method of identifying cases of autism was evaluating academic and medical records of eight-year-olds to identify those with professional diagnosis, special education classification, or IDC code at 11 sites in 11 states across the US. Soke et al. (2018) suggests 95% of 8-year-olds with autism have co-occurring conditions.

Intelligence and Autism

There is a correlation between severity of autism and intellectual disability: the more intellectually impaired a person is, the more severe their autism symptoms usually are (Clarke et al., 2016; Xie et al. 2020). However, there is also evidence that there is strong genetic overlap between autism and high cognitive abilities (Crespi, 2016; Hill et al., 2016; Xie et al, 2020). It's another paradox to ponder, and it isn't a new idea. It dates back to Asperger (1991) and Kanner (1943). Both noted that some of their first charges were from distinctly intelligent, well-educated, socioeconomically advantaged families (Asperger, 1991; Kanner, 1943). Trevis et al. (2020) found that 37% of the family members assessed for BAP in their study had superior to very superior FSIQ which is more than what the normal bell curve for the general population suggests should be found; approximately 16% should be above one standard deviation. The Trevis et al. (2020) study was inclusive of all autistic probands and not limited to those with a high IQ needing little support.

Lewton et al. (2018) found that people from the general population with higher degrees of autistic traits show enhanced deliberative processing and syllogistic reasoning. Deliberative processing, in contrast to intuitive processing, is effortful, sequential, and conscious (Lewton et al., 2018) such as that used in used in geometry proofs or higher

math. Syllogistic reasoning is using rules known to generate new logical information based on given premises. For example: all cats are black, and Betty is a cat, therefore Betty must be black. Khemlani and Johnson-Laird (2012) describe a syllogism as "arguments about properties of entities" (p. 427). Syllogistic reasoning is thought to reduce bias, and it is associated with general cognitive ability (Lewton et al., 2019). Intuitive processing is fast and instinctive as implied (Lewton et al., 2018), and it is responsible for emotional intelligence (Boyatzis et al., 2017). The two processes seem to operate in neurologically distinct pathways (Boyatzis et al., 2017). Lin et al. (2020) found this deliberative processing to impede social processing by impacting response time to social gestures among those high in autistic traits. This could be because those high in autistic traits are deliberatively exhausting all possible meanings of a facial expression before selecting a response (Baron-Cohen et al., 2009). Baron-Cohen et al., (2009) suggests this formal logic approach to reasoning is also responsible for talents associated with autism and also maths and sciences, hence, increase AQ scores among nuclear engineers is anticipated.

Common Genetic Factors for Autism and Intelligence

Nishiyama et al. (2009), found significant overlap between genetic factors that influence individual presentation of autistic traits and IQ. They also suggest several studies have sought to establish connection between familial intellectual disability and autism unsuccessfully (Nishiyama et al, 2009). Several studies (Bulik-Sullivan et al., 2015; Clark et al., 2015; Crespi, 2016; Hill et al., 2016; Nishiyama et al., 2009) have found overlap in genetic factors for autism risk and increased cognitive abilities.

Crespi (2016) hypothesized that autism is an imbalance of intelligence; connectivity is excessive when localized and inadequate at the global level (Belmonte et al., 2004; Crespi, 2016; Paul et al., 2021; Yoshimura et al., 2020). This makes sense considering that autism is the only psychiatric condition with notable rates of savantism (Crespi, 2016). Yoshimura et al., (2020) describes this as functional connectivity between but not within systems and notably among those with autistic traits in the general population. Belmonte et al. (2004) suggest the higher local connectivity is responsible for the sensory sensitivities common to autism. Baron-Cohen et al. (2009) later added that is it likely the explanation for attention to detail and systemizing attributed to autism as well. The localized connectivity is associated with enhanced abilities or interests characteristic of autism (Crespi, 2016). In severe autism this brain modularity also likely is responsible for reduced general intelligence (Crespi, 2016). Attention to detail that naturally occurs when you have within but not between connectivity is seen in those high in autistic traits (Baron-Cohen et al., 2009). Because of this, we expect to see elevated autistic traits in some people who have careers as engineers in the nuclear industry.

Autism in the Workforce

Many people who are autistic need additional support in the workforce (Farkas et al., 2020; Müller et al., 2003; Precin, 2010). Cox (2016-2021), like Harvard Health (Asperger's syndrome, 2014), found that neither true autism of those who are intellectually intact nor elevated traits of autism in non-clinical samples completely removed success potential from people. Extraordinary means of accommodation are not required for such a population (Cox, 2016-2021), but common sense and compassionate, ethical treatment were beneficial (Griffith et al., 2011; Hill, 2014; Müller et al., 2003).

Yet consistently, those with Asperger's have described difficulties in attaining employment commensurate with their abilities (Hurlbutt & Chalmers, 2004; Griffith et al., 2011; Müller et al., 2003). Techniques of accommodation are as simple and financially innocuous as guided imagery for skills could be beneficial (Precin, 2010).

Environmental Causes of Autism

Dickerson et al. also probed for occupational exposure to teratogens as a predictor of offspring diagnosis and instead found it predicted higher ADI-R scores but not greater likelihood of diagnosis. This echoed previous work suggesting teratogenic exposure may be linked to autism severity (Adams et al., 2007; Adams et al., 2012) but not causality. Known teratogenic environmental factors include exposure to lead (Parajuli et al., 2013) and combustion pollutants (Tang et al., 2008) among others (Dickerson et al., 2013). This would make sense if genetic predisposure is the primary cause and environmental exposure exacerbates the impairment, but the question if severity increases likelihood of diagnosis needs further disentanglement.

Nuclear plants typically have large diesel generators that may expose a person to combustion pollutants, and they use solid lead used for shielding, but they are not being implicated in the prevalence of traits demonstrated by workers who had those traits before getting the job. Non-ionizing radiation, like that which is emitted by a microwave or a cellular phone, has been questioned in association with autism (Kane, 2004; Thornton, 2006). Kane (2004) speculated because the increase in autism rate increased parallel to microwave use and cell phones it might be implicated as causal, but no connection has been demonstrated. Thornton (2006) merely proposed the hypothesis with no experiment.

Assortative Mating

Some may argue that people with high intelligence are prone to be ostracized by their peers for lacking empathy and other social skills (Abu Bakar & Ishak, 2018). There is some truth to people preferring those who are like them (Aronson et al., 2016) which may lead to a natural division. This is demonstrated in assortative mating, which refers to people who mate with those with whom they have phenotypical commonalities (Aronson et al, 2016; Crespi, 2016). Intelligence exhibits a strong correlation within assortative mating (Escorial & Martín-Buro, 2012), even above race and ethnicity. ASD showed higher rates of assortative mating when compared to various psychiatric disorders (Nordsletten et al., 2016). When two quirky tech workers mate and produce a child with profound autism it becomes apparent that their quirkiness is genetically indicative of autistic neurology (Sasson et al., 2013). For this reason, there is a survey question asking about offspring being diagnosed with autism, but it is embedded with other options so as not to become obvious what the intent is.

Autism and STEM

Having enhanced systemizing and attention to detail skills are desirable for engineers (Baron-Cohen, 2001). Even at the subclinical threshold, these traits manifesting as narrow fixations can be beneficial for technical skills and positions (Hill, 2014). Baron-Cohen et al. (2001) goes so far as to say autistic conditions are associated with scientific skills during the development of the AQ. Ruzich et al. (2015) adds that STEM occupations are a predicting factor in AQ scores. Dickerson et al. (2014) found that engineers are twice as likely to father children with autism and other paternal careers, like healthcare, accounting, and financial analysis, have greater odds. Dickerson et al. also

noted having the father only or both parents in technical, educated fields greatly increased ASD symptom severity, especially in the ADI-R domains of social impairment and communication. By Temple Grandin's observation, half of Silicon Valley has autism, but they avoid the label (Davenport, 2016). When comparing regions of similar socioeconomic development, it has been demonstrated that high tech areas may have higher rates of autism in school children (Roelfsema et al., 2011; Baron-Cohen, 2020).

The anonymous author of "A Visible Career on the Spectrum: An Engineer with Autism Explains How She Succeeded in the Workplace, and What Employers Can Do to be More Supportive" (2020) described her experiences in the workforce. She experienced substantial bullying, including physical aggression, often provoked by misunderstanding due to communication struggles or unknown reasons. She wasn't diagnosed until after beginning her career. She changed employers, and now advocates for openness, acceptance, and support for employees on the spectrum. It is stories like hers that justify assessing any industry for prevalence of traits to inform employers of best practices.

Autism and Engineering

Near the turn of this century there was a hashing out of the autism and engineering link between Baron-Cohen et al. (1997) and Jarrold and Roth (1998). Baron-Cohen et al. (1998) found that people with autism had about double the odds of having a father or grandfather that was an engineer, 28.4% versus 15% in a sample of 919 families. They attributed this to the skills of folk physics outpacing folk psychology (Baron-Cohen et al., 1997); *folk* implying the natural skillset a person is born with whether it is understanding the science of matter or science of mind. Jarrold and Roth (1998) used the data of Baron-Cohen et al. and ran additional correspondence analyses:

They did not disagree with the increased incidence of engineering occupations, but they added that other science, computing, and math-oriented jobs are also over-represented whereas manual laborers were negatively associated. Jarrold and Roth (1998) ended with a plea for caution and additional research. Baron-Cohen et al., (1998) obliged and found a statistically significant association only between engineering occupations and progenies with autism using a chi square analysis though other math, science, and computing fields still had higher incidences relative to the control group. The implication behooved a few readers of the *Autism* journal to write a letter to the editor with accusations of parent blaming and marginalizing, to which Baron-Cohen et al. (1998b) forbearingly replied and further analyzed his data to reiterate his stance. Since elevated traits have been found among engineers in several studies, it is expected to be present in the results.

Gender differences common to ASD and Engineering

Approximately 15% of the engineering workforce is female (National Science Foundation, 2021). Females represent about 9% of the workers in mechanical engineering (National Science Foundation, 2021). Holland (1996) would suggest this is the natural fall-out of interests dictating career. Others might feel it is social pressure or bias causing women to avoid male dominated careers to begin with or to quit after beginning a career (Li et al., 2017). About 80% of the autistic diagnosed population is male (APA, 2013). This similarity of male and female ratio between ASD and engineering should make no need for consideration of gender differences in evaluating the sample.

Religiosity and Autistic Traits

The divorce of science and religion was a messy one. Remaining tension has produced fewer than ideal studies on the natural phenomenon of religious tendencies. Autism makes a "distinctive, measurable, and predictable difference in religiosity" (Caldwell-Harris et al., 2011, p. 3362). Those who are high in autistic traits are far less likely than neurotypicals to participate in conventional religion (Caldwell-Harris et al., 2011). They are more likely to self-describe as atheist, agnostic, or independently spiritual with their own system (Caldwell-Harris et al., 2011). There are several possibilities why a systemizing, fact-loving, less socially inclined mind might struggle with organized religion or possibly be attracted to it. They may avoid because of the reduced social conformity (Yafai et al., 2018) or the necessity of agency for understanding the concept of an invisible god (Caldwell-Harris et al., 2011). Or they may be attracted to the rigid rules that do not change as fast as science, and they may expect to benefit from a group who profess to love one another with flaws and all (Caldwell-Harris et al., 2011). Certainly, more research needs to be done.

In Summary of the Literature Review

While there are thousands of studies on true autism, there are far fewer that focus on the adults with subclinical characteristics. Many studies have brought our attention to the fact that the systemizing brains of autism do well in STEM fields. No studies were identified looking at the specific subfield of the engineers within the nuclear industry.

The nuclear industry is unique in a few aspects. For one, it waxes and wanes in popularity with policy (Kitada, 2016). While the U.S. has not had a new plant since the 1980's, there is new interest promoted by green energy efforts to reduce carbon footprint. Many of the engineers in the nuclear industry were military trained because all Naval

seagoing vessels are now nuclear powered whereas many others earn a college degree without military experience. Veteran status may have the potential to generate a population of employees originating from less social connectedness and more behavioral issues compared to college-bound peers (Elder et al., 2010).

Based on the knowledge that people choose careers based on skills and interest, systemizing minds are very prevalent in engineering, systemizing minds are characteristic of autism, and the nuclear industry is ripe with prior military personnel, the hypothesis is made that we will see higher scores of autistic traits in the engineers of the nuclear industry compared to the general population. Another hypothesis is that nuclear engineers will have a greater rate of people scoring above six on the AQ10. Third, the researcher hypothesizes that previous research regarding propensities of those high in autistic traits will be reproduced in this sample: religious participation, social activity, and syllogistic reasoning skills.

"There's two possible outcomes: if the result confirms the hypothesis, then you've made a discovery. If the result is contrary to the hypothesis, then you've made a discovery."

Enrico Fermi

Method

Participants

Effort was made to distribute the survey through social media groups and through email to employees in the nuclear field to solicit participation of the target population, engineers in the nuclear field. This distribution also reached non-engineers and few of those not employed in the nuclear industry to form a general population comparison group. The social media groups included special interest groups like a former nuclear Navy page, NRC friends page, and email to attendees of the NRC's Regulatory Information Conference. The researcher failed to ensure that the general population pool was broad enough and not limited to those invested in nuclear power regulation or those previously in the nuclear Navy. All participants were adults assumed to be capable of consenting to participation with understanding of the limited risk involved in answering a survey and discussing job experiences.

The survey distribution generated 475 responses, of which 342 responses were complete enough to retain (n=342). Of those, 246 were male, 94 female, one preferred to not answer, and one identified as other. Three hundred eighteen identified as White (93%). Ten identified as multi-racial, all including white. The remaining 14 identified as Asian, Black or African American, Native American or Alaskan, Native Hawaiian or Pacific Islander, or other. The survey design lacked the nuance to capture a worldwide population ethnicity or race well. Qualtrics standard questions were used. The average age of respondents was about 53 years (μ=52.550, SD=13.527). One hundred sixty-nine respondents were engineers, 95 identified as nuclear engineers. Eighteen were female engineers, 16 females identified as nuclear engineers.

Veterans were overrepresented in the respondents. Seven percent of the US workforce population are veterans. This sample included 181 veterans or current military personnel (approximately 53%). This is due to the large response rate from sharing the survey in two nuclear Navy veterans' Facebook pages, Navy X Nuke and Navy Nucs. The survey lacked nuance to distinguish military branches or roles, but since these Facebook pages attracted a large response and there was no other means used for targeting veterans, it is reasonable to assume many of the 181 veterans were from the nuclear Navy.

Procedure

Attendees of the NRC's Regulatory Information Conference (RIC) were twice offered the Qualtrics survey sent through email. The survey was posted on two nuclear Navy veteran Facebook pages and a Facebook page called Nuclear Regulatory Commission (NRC) Friends. A very few responses were accumulated by QR code posted on the researcher's personal vehicle, and several respondents shared the survey via email or text. The researcher intended to distribute to graduate students at adult campuses in non-STEM fields for comparison, but when near half of the first 400 respondents indicated non-STEM employment the plan was aborted. This may have been a poor choice.

The survey consisted of the AQ10 (Allison et al, 2012) plus five other questions from the original AQ (Baron-Cohen et al, 2001), common demographics, open-ended questions that resemble the Critical Incident Technique (CIT, LR Gordon, Inc., 2014), a simple false syllogism, and a few questions relating to propensities; religious attendance, enjoyment of coworkers, and social activity. In addition to standard demographics, the

questions included the job title to separate the engineers from non-engineers and those in the nuclear field from those not in the nuclear filed. The survey distribution primarily took place during the month of April 2022, at the end of the Coronavirus pandemic. A question was added to the survey to account for impact on social activities and employment. Participants were asked about various mental health diagnoses for self and family.

The purpose of employing the CIT (LR Gordon, Inc., 2014) was collecting narrative data regarding work experiences that may reflect challenges common to those with higher AQ scores. The original purpose of the CIT is to gather "war stories" that can be evaluated to identify behaviors that contribute to success or failure of performance (LR Gordon, Incorporated, 2014, p. 1). Flanagan (1954) developed the technique to be an adaptable set of principles used to evaluate human performance, and it has been used across various fields of research thousands of times (LR Gordon, Inc., 2014). The methodology has even been incorporated into self-help books for parents of children with ADHD to evaluate their own performance (Barkley, 2020, p. 181). Responses were assessed using the Linguistic Inquiry and Word Count (LIWC) app for correlation between AQ scores and Summary Dimension scores in the domains of Analytic, Clout, Authentic and Tone. One might expect atypicality in any of those domains. Analytic writing reflects logical, orderly thinking but can be perceived as impersonal, rigid, and cold (Pennebaker Conglomerates, Inc., n.d.). Clout reflects the relative social status (Pennebaker Conglomerates, Inc., n.d.). Authentic is a measure of unfiltered, spontaneous interaction (Pennebaker Conglomerates, Inc., n.d.). Tone measures intensity of emotion

reflected in word choices (Pennebaker Conglomerates, Inc., n.d.). Each of these metrics touch on key diagnostic criteria of autism and should correlate with elevated AQ scores.

T-tests were conducted to evaluate AQ scores comparing those who identified as STEM or non-STEM, and another for veteran or civilian. An ANOVA was performed on AQ scores to compare the engineers of the nuclear industry to other STEM employees to non-STEM people. Additional t-tests were performed on the demographic data relative to AQ scores. A contingency table with a Chi Square test was run for goodness of fit between AQ10 cutoff scores and having a child with autism, and separately for various measures.

Measures

The AQ10 was developed originally to be a brief screener used by a general practitioner or other clinician when a patient presents with concerns of autism. Just ten questions are asked and then scored in a binary fashion though presented as a four point agree/disagree scale. The AQ or AQ10 can also be scored on a four-point system based on definitely agree to definitely disagree scale. A score above six suggests the patient should be evaluated by a professional with diagnostic skills. Above six, 80% are expected to meet diagnostic threshold (Allison et al, 2012). Administering the AQ10 to measure autistic traits to those without an autism diagnosis across the general or selected population is common for research purposes (Murray et al., 2013). Agelink van Rentergem et al. (2019) suggest the AQ10 is an appropriate tool for general population comparison of autistic traits for working age adults. The AQ10 has been criticized for having poor negative predictive validity, implying 64% of the negatives are false when used as a screener (Ashwood et al., 2016). The AQ10 is comprised of the items 15, 20,

27, 28, 31, 32, 36, 37, 41, and 45 from the Autism Spectrum Quotient (Agelink van Rentergem, 2019). In addition to the ten questions pulled from the original AQ, five others that show high reliability per Jia et al. (2019) were included to add nuance. The additional questions added to the survey were 7, 33, 38, 39, and 44. See the appendix for the list of questions. Collectively, these will be referred to as the AQ15 though it is not standardized as such. Questions about relationships have the potential to be impacted by age since the nature of relationships change as people age (Aronson et al., 2016), but Ruzich et al. (2015) report that age did not influence AQ scores. Agelink van Rentergem et al. (2019) did find an impact of reporting on those over 50 and concluded it was due to misunderstanding of the intent of select questions.

In addition to the AQ questions, participants were asked several questions about how often they socialize with their coworkers over the last year and how much they enjoy them to compare the respondents. Any quantity can be entered for the socialization question. Enjoyment responses generated a 1-10 number for comparison.

Participants were asked about mental health diagnoses for self and family. Also, an ANOVA was utilized to see if autism compared to other diagnoses is more prevalent in family members of engineers as Baron-Cohen and others have suggested it should be. It would also be informative as to whether there was a higher rate of people with autism working as engineers, in the STEM field, or non-STEM.

Since syllogistic reasoning was expected to have an association with autistic traits, a single syllogism was presented with instructions to assume the premises are true and make a conclusion. A timer was hidden on the page to see how long it took to answer the question.

Results

To address the question of prevalence:

A contingency table was generated to determine what the prevalence of engineers of the nuclear industry above the AQ10 cut off is in relation to the rest of the sample that was not nuclear engineers followed by Chi Square to see if the differences between the groups was significant. The two categories were nuclear engineer, yes or no, by above or below cutoff. We should fail to reject the null hypothesis: No significant difference was found. χ^2 (1, N=340) =2.4, p=.120. In this sample, nuclear engineers did not show greater rates of above cutoff AQ10 scores compared to the entire rest of the sample that included a high ratio of STEM respondents. See Table 1. However, the sample of respondents who were not nuclear engineers showed a rate 24 out of 245, approximately 10%. Nuclear engineers showed a rate of 15 out of 95, approximately 16%, above the cutoff. Both rates are far above the CDC's 2% estimate of autism within the general population. It is possible that a better test could be utilized to capture the differences between these groups.

Table 1

Contingency Tables

	Nuclear Engineer?		
AQcutoff6	no	yes	Total
Above	24	15	39
Below	221	80	301
Total	245	95	340

Chi-Squared Tests

	Value	df	p
X^2	2.422	1	0.120
N	340		

Research suggests mean AQ scores of STEM employees would be significantly higher than mean score of non-STEM. A t-test was conducted to compare the means of the AQ15 scores of STEM and non-STEM employees. The mean of the non-STEM sample was higher than anticipated, likely because of the sample sources. Even so, the 217 STEM employees scored significantly higher (M=32.1, SD=6.1) than the 123 non-STEM employees (M=29.8, SD=5.2), $t(338)=3.5$, $p<.001$, $d=.40$. In this situation we reject the null hypothesis: The STEM employees scored significantly higher on the AQ15 questions with a small effect size. See Table 2. See Figure 1.

Table 2

Independent Samples T-Test

						95% CI for Mean Difference			95% CI for Cohen's d	
	t	df	p	Mean Difference	SE Difference	Lower	Upper	Cohen's d	Lower	Upper
AQ15	3.496	338	< .001 [a]	2.291	0.655	1.002	3.579	0.395	0.171	0.618

Note. Student's t-test.

[a] Levene's test is significant ($p < .05$), suggesting a violation of the equal variance assumption

Group Descriptives

	Group	N	Mean	SD	SE
AQ15	STEM	217	32.120	6.102	0.414

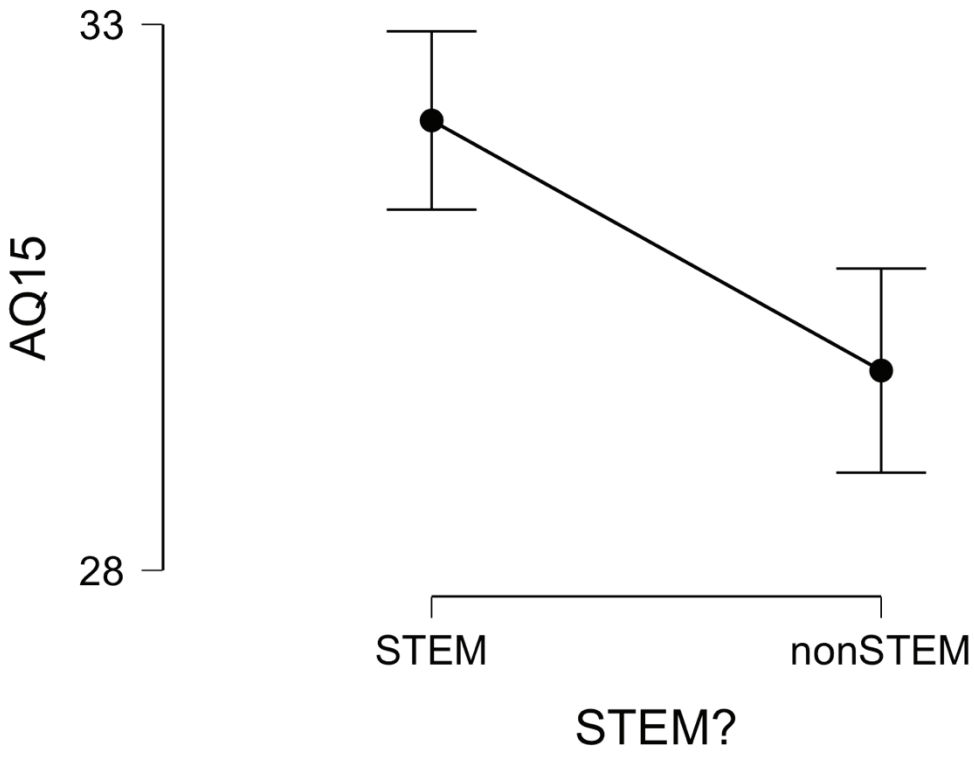
Group Descriptives

Group	N	Mean	SD	SE
nonSTEM	123	29.829	5.237	0.472

Entire Sample

	AQ10
Valid	340
Missing	2
Mean	3.371
Std. Deviation	1.886
Minimum	0.000
Maximum	10.000

Figure 1



To see if a significant difference exists between the STEM employees, if divided into the groups nuclear engineer, engineer non-nuclear, nuclear non-engineer, and other STEM that are neither nuclear nor engineer, an ANOVA was completed to compare the means of the AQ15 scores of the groups. The differences between the groups were non-significant: we should fail to reject the null hypothesis. Nuclear craft workers (*N*=17), those who are not engineers, scored the highest (*M*=33.8, *SD*=8.2). Other STEM workers (*N*=31) were next (*M*=33.3, *SD*=7.4), then engineers that were not in the nuclear industry (*N*=74, *M*=31.9, *SD*=5.5), and finally nuclear engineers (*N*=95, *M*=31.6, *SD*=5.6). This is in line with the expectations from research; many STEM fields will be inclined toward elevated autistic traits (Baron-Cohen et al, 2001; Jarrold & Roth, 1998; Ruzich et al, 2015). See Table 3.

Table 3

ANOVA - AQ15

Cases	Sum of Squares	df	Mean Square	F	p	η^2
Nuclear Engineer, Engineer, Nuclear non-Engineer, Other STEM, non-STEM_82	122.207	3	40.736	1.095	0.352	0.015
Residuals	7920.678	213	37.186			

Note. Type III Sum of Squares

Descriptives - AQ15

Nuclear Engineer, Engineer, Nuclear non-Engineer, Other STEM	Mean	SD	N
Engineer non-nuclear	31.932	5.483	74
Nuclear Engineer	31.579	5.637	95
Nuclear non-Engineer	33.824	8.218	17
STEM (others)	33.290	7.435	31

Speculation was made that the prevalence of veterans would make nuclear engineers score higher on the AQ questions, but engineers that were not nuclear had a significantly higher veteran prevalence within this sample. This may be due to sampling method. See Table 4.

Table 4

Contingency Tables

	Nuclear Engineer, Engineer non-Nuclear, Nuclear non-Engineer, Other STEM				
Military	**Engineer non-nuclear**	**Nuclear Engineer**	**Nuclear non-Engineer**	**STEM (others)**	**Total**
no	5	50	5	16	76
yes	69	44	12	14	139
Total	74	94	17	30	215

Chi-Squared Tests

	Value	df	p
X^2	44.074	3	< .001
N	215		

To investigate the prevalence of identifying as autistic among the categories Nuclear Engineer (*N*=93), Engineer non-nuclear (*N*=74), Nuclear non-engineer (*N*=17), STEM (not nuclear nor engineer) (*N*=31), and non-STEM (*N*=123) a contingency table was made and a chi square test run. We should reject the null hypothesis; a significant effect was found χ^2 (4, *N*=338) =13.35, *p*=.01. Only one out of 123 non-STEM

respondents identified as autistic and zero of the non-engineer nuclear workers. In comparison, eight of the engineers that were not nuclear, six of the nuclear engineers, and four of the other STEM respondents identified as autistic. See Table 5.

Table 5

Contingency Tables

	Nuclear Engineer, Engineer, Nuclear non-Engineer, Other STEM, non-STEM					
Autism	**Engineer non-nuclear**	**Nuclear Engineer**	**Nuclear non-Engineer**	**STEM (others)**	**nonSTEM**	**Total**
no	66	87	17	27	122	319
yes	8	6	0	4	1	19
Total	74	93	17	31	123	338

Chi-Squared Tests

	Value	**df**	**p**
X^2	13.348	4	0.010
N	338		

To address the question of propensities:

To see if there is a correlation between religious participation on AQ15 scores, as signified by number of times a person indicates attending services in a year, a Pearson Correlation was utilized. No correlation was indicated, $r(1)=-.03$, $p=.59$. It is appropriate to fail to reject the null hypothesis: AQ15 scores are not correlated with religious service attendance. See Table 6.

Table 6

Pearson's Correlations

Variable		AQ15	Number of Religious Services
1. AQ15	Pearson's r	—	
	p-value	—	
2. Number of Religious Services	Pearson's r	-0.029	—
	p-value	0.594	—

* p < .05, ** p < .01, *** p < .001

To see if there is an effect from military affiliation on the 15 questions from the AQ, scored on a 4-point scale, a t-test was utilized. This produced significant results $t(336) = -4.76$, $p < .001$, $d = -.52$. The group (N=181) of veterans and active military scored significantly higher (M=32.60, SD=6.04) than the group (N=157) that has never been in the military (M=29.65, SD=5.24). The null hypothesis should be rejected; military affiliation has a medium effect size on AQ scores. See Table 7. See Figure 2.

Table 7

Independent Samples T-Test

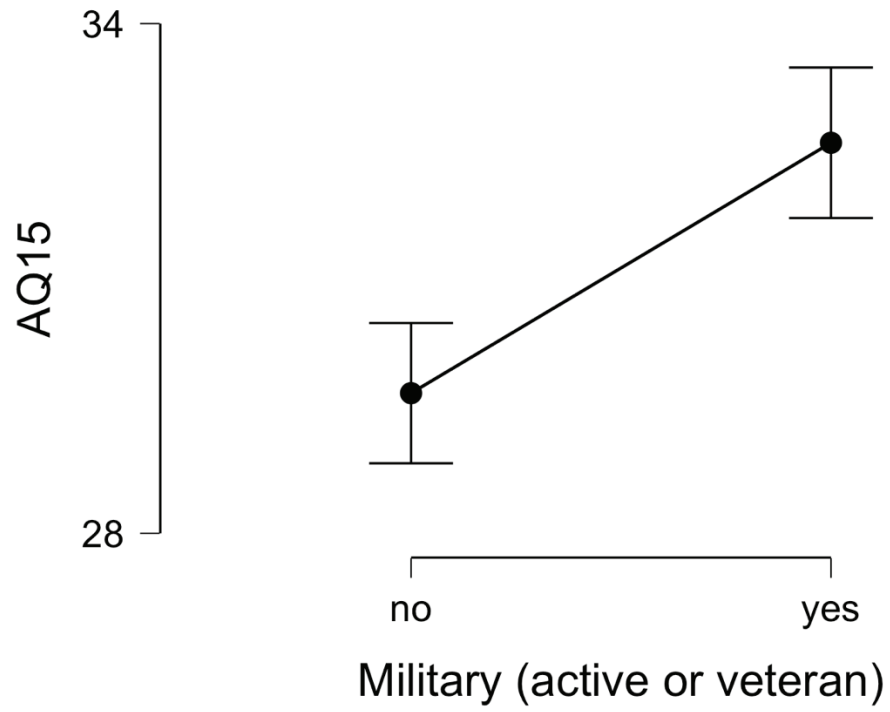
	t	df	p	Mean Difference	SE Difference	Cohen's d
AQ15	-4.758	336	< .001	-2.947	0.619	-0.519

Note. Student's t-test.

Group Descriptives

	Group	N	Mean	SD	SE
AQ15	Not military	157	29.650	5.235	0.418
	Vet/Active	181	32.597	6.039	0.449

Figure 2



To see if there is a correlation between identifying as being perceived as a stereotypical engineer on a scale of 1-10 with the 15 question AQ scores, a Pearson's Correlation was conducted. The null hypothesis can be rejected: There is a significant positive correlation between identifying as a stereotypical engineer and the AQ scores, Pearson's $r(340)=.31$, $p<.001$. See Table 8. See Figure 3.

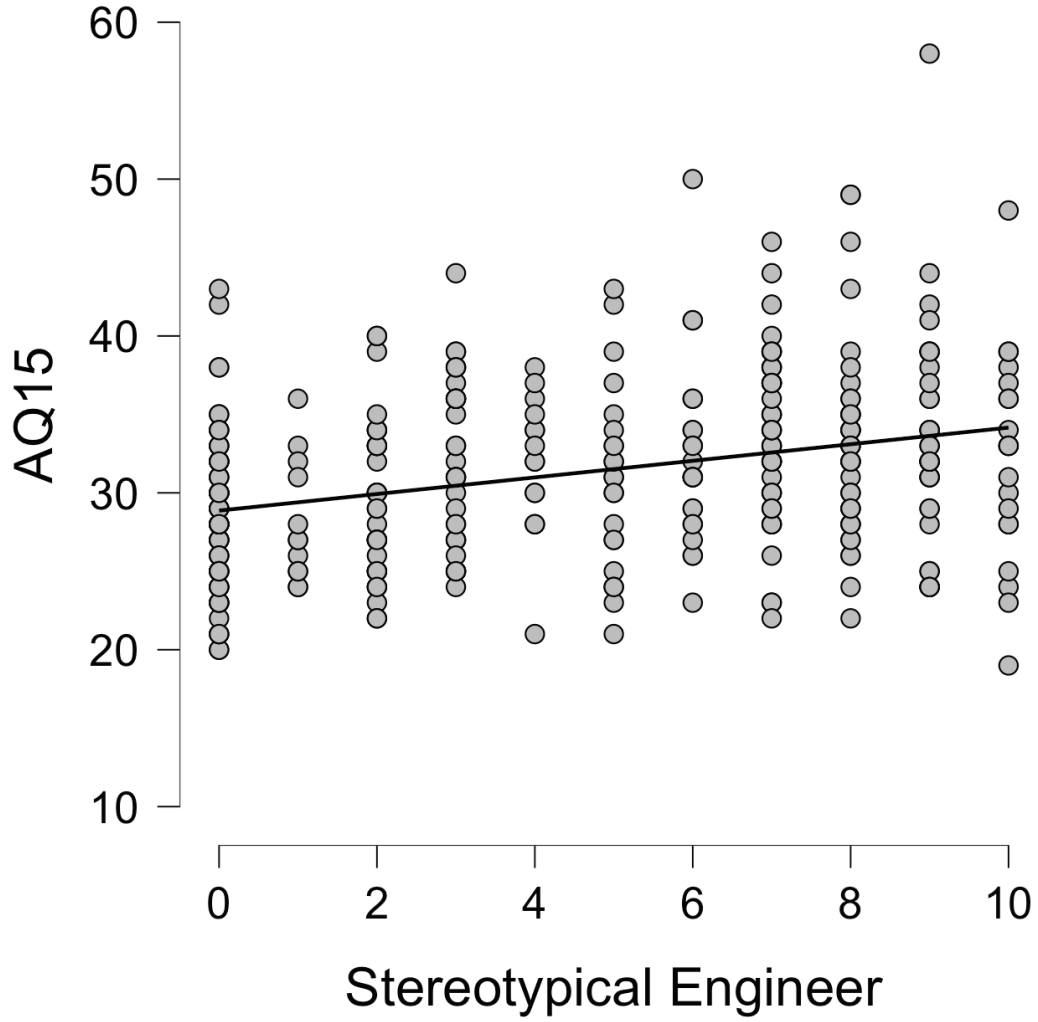
Table 8

Pearson's Correlations

		Pearson's r	p
Stereotypical Engineer	- AQ15	0.305 ***	< .001

* p < .05, ** p < .01, *** p < .001

Figure 3



To see if there is an effect from AQ15 scores on correct answer on the syllogism a t-test was conducted. We should fail to reject the null hypothesis: no effect was found, $t(337)=.31$, $p=.75$. The group that got the answer correct was much larger ($N=301$) and had a slightly higher AQ score ($M=31.35$, $SD=5.58$) compared to the group that got the answer wrong ($N=38$, $M=31.03$, $SD=8.09$). See Table 9.

Table 9

Independent Samples T-Test

	t	df	p
AQ15	0.314	337	0.754

Note. Student's t-test.

Group Descriptives

	Group	N	Mean	SD	SE
AQ15	Right	301	31.346	5.578	0.322
	Wrong	38	31.026	8.092	1.313

To see if there is an effect from AQ scores on time needed to complete the syllogism a Pearson Correlation was conducted. We can fail to reject the null hypothesis; no correlation was found, Pearson's $r(339)=.02$, $p=.71$. See Table 10. See Figure 4.

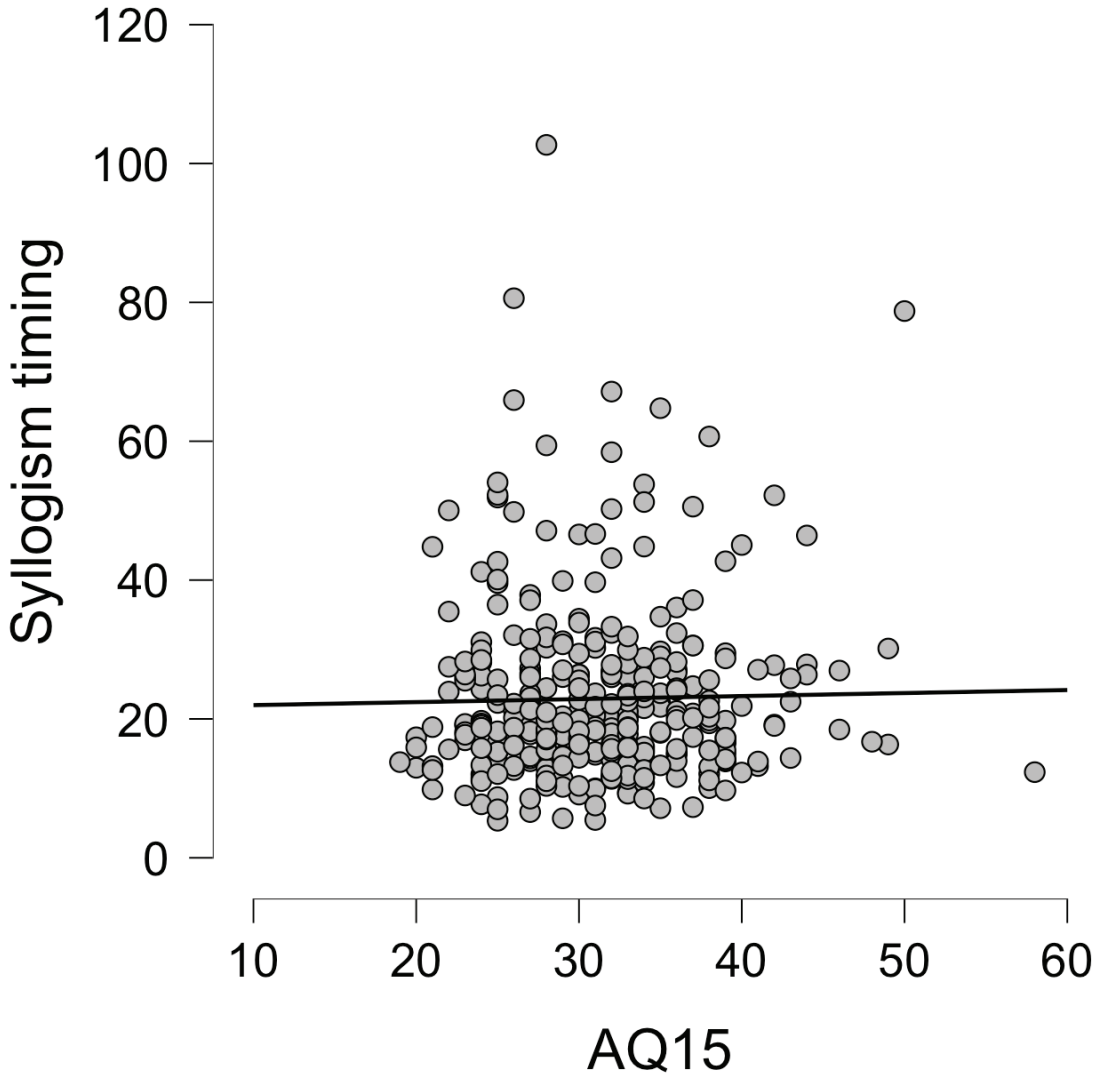
Table 10

Pearson's Correlations

		Pearson's r	p
AQ15	- Syllogism timing	0.020	0.711

* p < .05, ** p < .01, *** p < .001

Figure 4



The CIT portion was examined by scores in the domains of analytic, clout, authentic, and tone for correlation to AQ scores for 15 questions. A Pearson Correlation was conducted for positive and negative responses combined in each domain. We can fail to reject the null hypothesis because no correlation was found between the AQ15 scores and any domain. In the analytic domain, Pearson's $r(339)=-.06$, $p=.32$. In the clout

domain, Pearson's $r(339)=.01$, $p=.87$. In the authentic domain, Pearson's $r(339)=.05$, $p=.44$. In the tone domain, Pearson's $r(339)=-.05$, $p=.40$. See Table 11.

Table 11

Pearson's Correlations

Variable		AQ15 score	Analytic	Clout	Authentic	Tone
1. AQ15 score	Pearson's r	—				
	p-value	—				
2. Analytic	Pearson's r	-0.060	—			
	p-value	0.318	—			
3. Clout	Pearson's r	0.010	0.004	—		
	p-value	0.870	0.946	—		
4. Authentic	Pearson's r	0.046	-0.321	-0.234	—	
	p-value	0.437	< .001	< .001	—	
5. Tone	Pearson's r	-0.050	-0.185	-0.006	0.123	—
	p-value	0.400	0.002	0.916	0.038	—

The CIT was examined by word count in both the positive and negative responses for a correlation with AQ15 scores. No correlation was found between word count and AQ15 scores; we fail to reject the null hypothesis; Pearson's $r(286)=-.09$, $p=.11$ for correlation between Positive CIT responses and AQ15 scores, Pearson's $r(283)=-.10$, $p=.10$ for correlation between Positive CIT responses and AQ15 scores. A correlation was demonstrated between Positive CIT responses and Negative CIT responses, Pearson's $r(273)=-.59$, $p<.001$. See Table 12.

Table 12

Pearson's Correlations

Variable		AQ15	+ CIT word count	- CIT word count
1. AQ15	n	—		
	Pearson's r	—		
	p-value	—		
2. + CIT word count	n	286	—	
	Pearson's r	0.094	—	
	p-value	0.112	—	
3. - CIT word count	n	283	273	—
	Pearson's r	0.097	0.592	—
	p-value	0.104	< .001	—

To see if nuclear engineers progenerate offspring with autism more often than all others combined, a contingency table and chi squared test was utilized. We can reject the null hypothesis because a significant difference was found χ^2 (1, N=322) =5.90, p=.02. Eleven of the 89 nuclear engineers have children with autism compared to 11 of the 233 respondents who were not nuclear engineers, including all other STEM and nuclear. Six of the nuclear engineers chose not to answer this question: Three of the others declined. See Table 13.

Table 13

Contingency Tables

	Nuclear Engineer		
Child with Autism	no	yes	Total
no	222	78	300
yes	11	11	22

Contingency Tables

Child with Autism	Nuclear Engineer		Total
	no	yes	
Total	233	89	322

Chi-Squared Tests

	Value	df	p
X^2	5.903	1	0.015
N	322		

When observation was made that the entire sample tended high on AQ10 scores compared to the scores published, an unpaired t-test was conducted comparing the control group from Allison et al (2012) to this sample using graphpad.com. With a null hypothesis that there was no difference, we can reject the null hypothesis. The sample from this study (N=340, M=3.37, SD=1.89) was significantly different from the control group (N=642, M=2.77, SD=2), t(980)=4.57, p<.001. Obviously, this could impact the comparisons made within this sample.

Exploratory Analysis

A matrix of correlations was made for all 15 numerical variables. The list includes enjoyment of coworkers, stereotypical engineer, positive CIT word count, negative CIT word count, socialize with coworker count, syllogism timing, AQ10, AQ15, analytic CIT score, clout CIT score, authentic CIT score, tone CIT score, age, number of religious services attended, and total survey duration. Several correlations were significant. Enjoying coworkers and socializing with coworkers showed significant correlation, $r(324)=.21$, $p<.001$. Both AQ10 ($r(327)=-.27$, $p<.001$) and AQ15 ($r(327)=-.19$, $p<.001$)

showed negative correlation with enjoying coworkers. Enjoying the company of coworkers showed significant correlation with number of religious services attended $r(321)=.15$, $p=.006$). Higher stereotypical engineer scores corelated to higher AQ10 ($r(336)=.31$, $p<.001$) and AQ15 ($r(336)=.26$, $p<.001$) scores as well as age ($r(340)=-.28$, $p<.001$). Other correlations were not significant.

A contingency table was created to see how well the AQ10 identified the autistic respondents. The AQ10 did not do well. Eleven of the 19 respondents who identified as autistic were below the AQ10 cutoff of six. This aligns with the Ashwood et al. (2016) criticism that it produces many false negatives. See Table 14.

Table 14

Contingency Tables

	Autism		
AQcutoff6	**no**	**yes**	**Total**
Above	30	8	38
Below	289	11	300
Total	319	19	338

Discussion

The purpose of this study was to identify prevalence of autistic traits among engineers of the nuclear industry. Previous studies have looked at autistic traits among various STEM professions but not specifically at nuclear engineers. Additionally, the

researcher hoped to investigate propensities previously identified as being characteristic of those high in autistic traits: low religious attendance, low social activity, low enjoyment of coworkers, and better syllogistic reasoning skills. Because engineer syndrome and autistic traits are so similar, an association between higher AQ15 scores and being perceived as a stereotypical engineer was investigated.

Nuclear engineers with all other engineers, nuclear workers, and other STEM employees demonstrated elevated autistic traits compared to the non-STEM group. The differences between nuclear engineers and others within the STEM group were not significant though engineers of the nuclear industry scored lowest. It was argued that the high rate of veterans in the nuclear engineers would influence the higher AQ scores, but the engineers that reported they did not work in the nuclear industry had a much higher prevalence of veterans. The prevalence of engineers of the nuclear industry scoring above six was about 16 percent, 15 out of 95. Six out of 93 engineers of the nuclear industry identified as autistic. This is higher than anticipated and is surprising for an older population. It is about three times the CDC's estimated 2% of the general population.

Veteran status also is associated with elevated autistic traits. The variable of veteran status could present a chicken and egg conundrum requiring a full longitudinal study to sort out. It's cliché for veterans to justify rigidity due to military training, but would a person even enlist if they weren't open to such rigidity? The peculiarities of personality self-described among sailors during the first few years of Navy Nuclear Power schooling were not likely due to the brief experience of military training, but more likely facets of personality that pre-existed the experience and filtered into the program via ASVAB scores; hence why sailor-made memes exist about Admiral Rickover training

"questionably autistic man-children" to run nuclear power plants. There are some who collectively self-identify the group's autistic traits.

AQ scores did not correlate to number of religious services attended. Previous research suggested higher scores would negatively correlate with conventional religion. It is possible that it polarizes attendance. Different tests would need to be done to see if that is the case. No significant difference was found relating to the syllogism. Further testing should be done.

The elevated rate of autistic offspring among engineers of the nuclear industry is interesting and worth investigating further. An a priori power analysis was conducted suggesting a sample of merely 44 would have produced α=.05 and Power of .8. Three hundred forty respondents were included in this analysis. Association is evident, and the sample size was large enough to have valuable indication. Why do nuclear engineers progenerate offspring with autism at a higher rate than other engineers despite having AQ scores and diagnosis rates in line with other engineers? Literature reviewed here would suggest genetic predisposition of the parent being related to both career choice and producing offspring with autism, but that alone would have produced a similar rate across all STEM. Toxic exposure is an unlikely contributor to *rate* of autism as previously reviewed (Adams et al., 2007; Adams et al., 2012), but it could impact severity (Adams et al., 2007; Adams et al., 2012; Dickerson et al., 2013). Further research is warranted.

All the diagnoses queried on the survey, except for bipolar disorder, showed elevated autistic traits; ADHD/ADD, autism, anxiety, depression, dyslexia/dyscalculia, high IQ/gifted, OCD, and PTSD. Much previous research has supported evidence of elevated autistic traits among mental health diagnoses. It would be worth investigating

further if these individuals are misidentifying their traits, such as self-identified OCD and introversion, because their perception of autism is associated with intellectual disability and verbal limitations. It is also possible that comorbidities are represented here. Disentangling that was beyond the scope of this limited survey.

Engineers who have higher AQ scores recognize that they may be perceived as stereotypical engineers based on the positive correlation between AQ scores and the survey question about being perceived as a stereotypical engineer. They can see the intensities of their interests and when they are described in a positive manner it is not offenseive. Black and white thinking and low insight might hinder receptiveness to being described as high in autistic traits but using the term stereotypical engineer or engineer syndrome may increase receptiveness to soft skill training. As Jenkins (2021) suggested, soft skill training should be offered to all from early in a career. Better soft and social skills have the potential to dually impact work by improving home life to make a more satisfied employee and work interactions.

Interestingly, being high in autistic traits reduced enjoyment of coworkers but not number of times a person socialized with coworkers. This output could have been impacted by the pandemic though the majority of the respondents said the pandemic has not impacted their social activity or employment in the last year. Did everyone socialize less? Were even those who are high in autistic traits feel like socializing after social distancing for so long? Do overestimate the introverted nature of autistic traits?

The CIT portion of the survey was underutilized. Additional qualitative research might produce useful information about relationships between managers and workers within the industry and for those elevated in autistic traits. Micromanaging stands out as a

theme of the negative CIT responses. Three women reported sexual harassment or misconduct. Of the three, one was diagnosed with autism and the other was above the AQ10 cutoff. The positive responses very rarely reflected on expertise and more often prized being nurtured and respected. The lack of relationship between word count and autistic traits may have demonstrated the hypo- and hyper-verbosity balancing each other out. Or possibly associating word deficits with intellectually intact autistic people is just inappropriate entirely. There is small evidence for both previously noted in the literature review. Further evaluations of this sample should be conducted. Since the two CIT questions ask for positive and negative experiences, a comparison was made between to distinguish if AQ scores relate to greater positive word count or greater negative word count at a future time and none was found. Higher word count in each positive and negative was related to each other though.

Limitations

Multiple limitations exist and various errors were made. Respondents did not decipher the question “Do you work in a STEM (Science, Technology, Engineering, Math) field and/or have a STEM degree? If you're a student, are you working toward a STEM degree?” well. Even though STEM was spelled out, several people who identified as physicists, nuclear engineers, or mathematicians answered negative. Where it was obvious that the data was incorrect, the answer was corrected. However, many job titles did not indicate the nature of the field of work. This makes the divisions of categories imprecise. Another suspected problem with wording was the question “Do you work in the nuclear industry?”. Regulators in the nuclear industry distinguish themselves from “the industry” workers. Using the term industry may signify being an employee of a

licensee to a regulator. The division between STEM and non-STEM and nuclear industry and not nuclear industry is not as clear as desired. Both concerns would suggest more respondents should have identified as STEM and nuclear industry.

Critical Incident Technique responses tended to be brief in non-sentence form. Was this because the people of this sample were all so analytical in nature? Does this impact the functionality of LIWC? Distinctions between those higher in autistic traits and lower should have been more evident if the AQ and LIWC accurately reflect what they intend to measure and the sample was well distributed across the measured domains. These social and linguistic differences are core traits of autism.

This sample was drawn primarily from nuclear Navy veteran and NRC employee Facebook groups and from attendees of the RIC conference. The sampling technique may have skewed the entire sample toward a more STEM inclination than intended. It is possible that many of the respondents are prior nuclear Navy even if they currently did not identify as employees in the nuclear industry or other STEM; sometime in their past they may have been. My division of nuclear and non-nuclear may not have been precise due to limitations of the survey. Also, the RIC is a public conference open to anyone, but attendees are primarily to those who are interested in the regulation of nuclear power, including health agencies and politicians. Only three respondents are known to have responded by QR code and not email to RIC attendees, social media, or the anonymous link that was shared among some engineers and academics at the university. It is worth noting that the whole sample (N=338, for this question) had 19 individuals that identified as autistic, approximately 6%. That is an elevated rate of diagnosis, especially for a population with the average age of 55. Eighteen of the autistic respondents identified as

STEM (N=215), which makes about an 8% rate of diagnosis. Only one was non-STEM. This extraordinary sample may have caused muting of effect between groups within the sample.

Future Research

Results of this study should indicate nuclear engineers are inclined to elevated autistic traits like other engineering and STEM occupations, which is significantly different form non-STEM occupations. Future research might investigate the impact of autistic traits on adherence to safety protocol or impact on safety culture. Should STEM management promotions criteria differ dramatically from non-STEM? Does the reduced impact of social pay make those high in traits more reliable safety decision makers? How does subclinical autism interact with the classic moral dilemma? Because the nuclear industry is distinct from Silicon Valley in eminence of potential harm if an accident were to occur, how should it hire and promote employees distinctly? Where should technical prowess be valued more than soft skills in managerial positions? Are elevated autistic traits highly desirable in certain positions?

It was unexpected that nuclear engineers reproduce autistic offspring at such an elevated rate even compared to other engineers. Because this sample drew such a large portion of the respondents from Facebook groups that were prior Navy nukes but the survey did not ask specifically for that history, the division between ever nuclear and never nuclear is not decipherable. Additional research should be conducted to explore the correlation.

References

A visible career on the spectrum: An engineer with autism explains how she has succeeded in the workplace, and what employers can do to be more supportive. (2020). *TCE: The Chemical Engineer, 945,* 20-23. https://www.thechemicalengineer.com/features/a-visible-career-on-the-spectrum/

Abu Bakar, A. Y., & Ishak, N. M. (2018). The relationship of interpersonal and leadership skills with empathic understanding among Malaysian gifted students. *Journal for the Education of Gifted Young Scientists*, *6*(3), 30–38. https://doi.org/10.17478/jegys.2018.79

Adams, J. B., Audhya, T., McDonough-Means, S., Rubin, R. A., Quig, D., Geis, E., Gehn, E., Loresto, M., Mitchell, J., Atwood, S., Barnhouse, S., & Lee, W. (2012). Toxicological status of children with autism vs. Neurotypical Children and the association with autism severity. *Biological Trace Element Research*, *151*(2), 171–180. https://doi.org/10.1007/s12011-012-9551-1

Adams, J. B., Romdalvik, J., Ramanujam, V. M., & Legator, M. S. (2007). Mercury, lead, and zinc in baby teeth of children with autism versus controls. *Journal of Toxicology and Environmental Health, Part A*, *70*(12), 1046–1051. https://doi.org/10.1080/15287390601172080

Agelink van Rentergem, J. A., Lever, A. G., & Geurts, H. M. (2019). Negatively phrased items of the Autism Spectrum Quotient function differently for groups with and without autism. *Autism*, *23*(7), 1752–1764. https://doi.org/10.1177/1362361319828361

Ailworth, E. (2018, December 28). *High-paying jobs in nuclear power aren't Looking so safe anymore*. The Wall Street Journal. Retrieved January 17, 2022, from https://www.wsj.com/articles/high-paying-jobs-in-nuclear-power-arent-looking-so-safe-anymore-11545993000

Alli, R. A. (2020, December 5). *Autism spectrum disorder (ASD) treatment*. WebMD. Retrieved January 24, 2022, from https://www.webmd.com/brain/autism/understanding-autism-treatment

Allison, C., Auyeung, B., & Baron-Cohen, S. (2012). Toward brief "Red flags" for autism screening: The short autism spectrum quotient and the short quantitative checklist in 1,000 cases and 3,000 controls. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(2). https://doi.org/10.1016/j.jaac.2011.11.003

Alvares, G. A., Bebbington, K., Cleary, D., Evans, K., Glasson, E. J., Maybery, M. T., Pillar, S., Uljarević, M., Varcin, K., Wray, J., & Whitehouse, A. J. (2020). The misnomer of 'high functioning autism': Intelligence is an imprecise predictor of functional abilities at diagnosis. *Autism*, *24*(1), 221–232. https://doi.org/10.1177/1362361319852831

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). https://doi.org/10.1007/978-1-4419-1698-3_14

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

An, J. Y., Lin, K., Zhu, L., Werling, D., Dong, S., Brand, H., Wang, H., Zhao, X., Sestan, N., State, M., Willsey, J., Talkowski, M., Devlin, B., Roeder, K., & Sanders, S. (2019). Insights into the contribution of rare noncoding variation in Autism Spectrum Disorder through family-based whole-genome sequencing. *European Neuropsychopharmacology, 29*(5), S36. https://doi-org.zeus.tarleton.edu/10.1016/j.euroneuro.2019.07.073

Anunciação, L. (2018). An overview of the history and methodological aspects of psychometrics. https://doi.org/10.31235/osf.io/mtfjy

Araujo, D. J., Tjoa, K., & Saijo, K. (2019). The endocannabinoid system as a window into microglial biology and its relationship to autism. *Frontiers in Cellular Neuroscience*, *13*. https://doi.org/10.3389/fncel.2019.00424

Aronson, E., Wilson, T. D., Akert, R. M., Sommers, S. R. (2016). Social psychology. Pearson.

Ashwood, K., Gillan, N., Horder, J., Hayward, H., Woodhouse, E., McEwen, F. S., Findon, J., Eklund, H., Spain, D., Wilson, C. E., Cadman, T., Young, S., Stoencheva, V., Murphy, C. M., Robertson, D., Charman, T., Bolton, P., Glaser, K., Asherson, P., & Simonolff, E. (2016). Predicting the diagnosis of autism in adults using the Autism-Spectrum Quotient (AQ) questionnaire. *Psychological Medicine, 46*(12), 2595-2604. https://doi.org/10.1017/S0033291716001082

Asperger, H. (1991). 'Autistic psychopathy' in childhood. Edited by Uta Frith. *Autism and Asperger Syndrome*, 37–92. Originally published as "Die 'Autistischen Psychopathen' im Kindesalter," *Archiv für Psychiatrie und*

Nervenkrankenheiten 117 (1944):76-136. https://doi.org/10.1017/cbo9780511526770.002

Asperger's syndrome. Harvard Health. (2014, March 9). Retrieved January 15, 2021, from https://www.health.harvard.edu/newsletter_article/aspergers-syndrome

Atomic Heritage Foundation. (2017, July 18). *The Einstein-Szilard letter - 1939*. Atomic Heritage Foundation. Retrieved January 24, 2022, from https://www.atomicheritage.org/history/einstein-szilard-letter-1939

Barkley, R. A. (2020). *Taking charge of ADHD: the complete, authoritative guide for parents.* Gilford Press.

Baron-Cohen, S. (2015). Leo Kanner, Hans Asperger, and the discovery of autism. *The Lancet*, *386*(10001), 1329–1330. https://doi.org/10.1016/s0140-6736(15)00337-2

Baron-Cohen, S. (2020, December 12). *How autism and invention are connected*. The Wall Street Journal. Retrieved January 18, 2022, from https://www.wsj.com/articles/how-autism-and-invention-are-connected-11607749260?reflink=share_mobilewebshare&fbclid=IwAR0HsJ_E3EfirT6edT40I9ofJPlH1fjJucr_fxTvGHXi5tcutKAwYSroYKU

Baron-Cohen, S., Ashwin, E., Ashwin, C., Tavassoli, T., & Chakrabarti, B. (2009). Talent in autism: Hyper-systemizing, hyper-attention to detail and sensory hypersensitivity. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1522), 1377–1383. https://doi.org/10.1098/rstb.2008.0337

Baron-Cohen, S., Bolton, P., Wheelright, S., Scahill, V., Short, L., Mead, G., Smith., A. (1998). Does Autism Occur More Often in Families of Physicists, Engineers, and

Mathematicians? *Autism*, *2*(3), 296–301. https://doi.org/10.1177/1362361398023008

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*(1), 5–17. https://pubmed.ncbi.nlm.nih.gov/11439754/

Baron-Cohen, S., Wheelwright, S., Stott, C., Bolton, P., & Goodyer, I. (1997). Is there a link between engineering and autism? *Autism*, *1*(1), 101–109. https://doi.org/10.1177/1362361397011010

Baron-Cohen, S., Wheelwright, S., Stott, C., Bolton, P., & Goodyer, I. (1998b). Engineering and autism: Exploring the link further: Reply to Wolff, Braunsberg and Islam. *Autism*, *2*(1), 98–104. https://doi.org/10.1177/1362361398021016

Belmonte, M. K., Allen, G., Beckel-Mitchener, A., Boulanger, L. M., Carper, R. A., & Webb, S. J. (2004). Autism and abnormal development of brain connectivity. *The Journal of neuroscience: The official journal of the Society for Neuroscience*, *24*(42), 9228–9231. https://doi.org/10.1523/JNEUROSCI.3340-04.2004

Ben-Sasson, A., Gal, E., Fluss, R., Katz-Zetler, N., & Cermak, S. A. (2019). Update of a meta-analysis of sensory symptoms in ASD: A new decade of research. *Journal of Autism and Developmental Disorders*, *49*(12), 4974–4996. https://doi.org/10.1007/s10803-019-04180-0

Bernard, S. F. (2011, March 26). *Let no one ignorant of geometry enter.* Frequently asked questions about Plato. Retrieved February 14, 2021, from https://www.dialogues-de-platon.org/faq/faq009.htm#note1

Bernardidni, C. & Bonolis, L. (2001). Enrico Fermi: his work and legacy. Springer

Berthoz, S., Lalanne, C., Crane, L., & Hill, E. L. (2013). Investigating emotional impairments in adults with autism spectrum disorders and the broader autism phenotype. *Psychiatry Research*, *208*(3), 257–264. https://doi.org/10.1016/j.psychres.2013.05.014

Bishop, D. V., Maybery, M., Maley, A., Wong, D., Hill, W., & Hallmayer, J. (2004). Using self-report to identify the broad phenotype in parents of children with autistic spectrum disorders: A study using the Autism-Spectrum Quotient. Journal of Child Psychology and Psychiatry, 45(8), 1431–1436. doi:10. 1111/j.1469-7610.2004.00325.x.

Bishop, S. L., & Seltzer, M. M. (2012). Self-reported autism symptoms in adults with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *42*(11), 2354–2363. https://doi.org/10.1007/s10803-012-1483-2

Boorse, J., Cola, M., Plate, S., Yankowitz, L., Pandey, J., Schultz, R., & Parish-Morris, J. (2019). Linguistic markers of autism in girls: evidence of a "blended phenotype" during storytelling. *Molecular Autism*, (10), 1. https://doi-org.zeus.tarleton.edu/10.1186/s13229-019-0268-2

Booth, T., Murray, A. L., McKenzie, K., Kuenssberg, R., O'Donnell, M., & Burnett, H. (2013). Brief report: An evaluation of the AQ-10 as a brief screening instrument

for ASD in adults. *Journal of Autism and Developmental Disorders*, *43*(12), 2997–3000. https://doi.org/10.1007/s10803-013-1844-5

Börner, K., Scrivner, O., Gallant, M., Ma, S., Liu, X., Chewning, K., Wu, L., & Evans, J. A. (2018). Skill discrepancies between research, education, and jobs reveal the critical need to supply soft skills for the data economy. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(50), 12630–12637. https://doi.org/10.1073/pnas.1804247115

Boyatzis, R., Rochford, K., & Cavanagh, K. V. (2017). Emotional intelligence competencies in Engineer's effectiveness and engagement. *Career Development International*, *22*(1), 70–86. https://doi.org/10.1108/cdi-08-2016-0136

Bulik-Sullivan, B., Finucane, H. K., Anttila, V., Gusev, A., Day, F. R., Duncan, L., Perry, J. R. B., Patterson, N., Robinson, E., Daly, M. J., Price, A. L., & Neale, B. M. (2015). An atlas of genetic correlations across human diseases and traits. https://doi.org/10.1101/014498

Caldwell-Harris, C., Murphy, C. F., Velazquez, T., & McNamara, P. (2011). Religious Belief Systems of Persons with High Functioning Autism. Retrieved from https://escholarship.org/uc/item/6zh3j3pr.

Cassidy, D. C. (2009). *J. Robert Oppenheimer and the American Century*. Johns Hopkins University Press.

CBS. (1984). *Admiral Hyman Rickover "60 Minutes" Interview by Diane Sawyer*. Retrieved from https://vimeo.com/56270169.

Changkajonsakdi, B., & Kaewkuekool, S. (2019). Development of Soft Skills Learning Management Model for automotive parts industry in Thailand. *International*

Journal of Innovation and Learning, *26*(4), 364. https://doi.org/10.1504/ijil.2019.102903

Clarke, T. K., Lupton, M. K., Fernandez-Pujals, A. M., Starr, J., Davies, G., Cox, S., Pattie, A., Liewald, D. C., Hall, L. S., MacIntyre, D. J., Smith, B. H., Hocking, L. J., Padmanabhan, S., Thomson, P. A., Hayward, C., Hansell, N. K., Montgomery, G. W., Medland, S. E., Martin, N. G., … McIntosh, A. M. (2015). Common polygenic risk for autism spectrum disorder (ASD) is associated with cognitive ability in the general population. *Molecular Psychiatry*, *21*(3), 419–425. https://doi.org/10.1038/mp.2015.12

Constantino, J. N., & Todd, R. D. (2003). Autistic traits in the general population. *Archives of General Psychiatry*, *60*(5), 524. https://doi.org/10.1001/archpsyc.60.5.524

Cox, B. (Principal Investigator). (2016-2021). Autism-related characteristics in college STEM students: prevalence, performance, and mediation. (Award number 1612090) [Grant]. Florida State University. https://www.nsf.gov/awardsearch/showAward?AWD_ID=1612090

Crespi, B. J. (2016). Autism as a disorder of high intelligence. *Frontiers in Neuroscience*, *10*. https://doi.org/10.3389/fnins.2016.00300

Davenport, M. (2016, August 12). *Temple Grandin: 'half of Silicon Valley's got mild autism'*. The Mercury News. Retrieved January 18, 2022, from https://www.mercurynews.com/2014/01/21/temple-grandin-half-of-silicon-valleys-got-mild-autism/

Department of Energy Office of Nuclear Energy. (2021, March 23). *5 fast facts about nuclear energy*. Energy.gov. Retrieved January 21, 2022, from https://www.energy.gov/ne/articles/5-fast-facts-about-nuclear-energy

Dickerson, A. S., Pearson, D. A., Loveland, K. A., Rahbar, M. H., & Filipek, P. A. (2014). Role of parental occupation in autism spectrum disorder diagnosis and severity. *Research in autism spectrum disorders*, *8*(9), 997–1007. https://doi.org/10.1016/j.rasd.2014.05.007

Duncan, F. (1990). *Rickover and the Nuclear Navy: The Discipline of Technology*. Naval Institute Press.

Dworzynski, K., Ronald, A., Bolton, P., & Happé, F. (2012). How different are girls and boys above and below the diagnostic threshold for Autism Spectrum Disorders? *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(8), 788–797. https://doi.org/10.1016/j.jaac.2012.05.018

Ehsan, H., Rispoli, M., Lory, C., & Gregori, E. (2018). A systematic review of STEM instruction with students with autism spectrum disorders. *Review Journal of Autism and Developmental Disorders*, *5*(4), 327–348. https://doi.org/10.1007/s40489-018-0142-8

Elder, G. H., Wang, L., Spence, N. J., Adkins, D. E., & Brown, T. H. (2010). Pathways to the all-volunteer military. *Social Science Quarterly*, *91*(2), 455–475. https://doi.org/10.1111/j.1540-6237.2010.00702.x

Engelbrecht, N. (2021, December 13). *Autism & high IQ*. Embrace Autism. Retrieved January 27, 2022, from https://embrace-autism.com/autism-and-high-iq/

Escorial, S., & Martín-Buro, C. (2012). The role of personality and intelligence in assortative mating. *The Spanish Journal of Psychology*, *15*(2), 680–687. https://doi.org/10.5209/rev_sjop.2012.v15.n2.38879

Farkas, T. N., Mendy, J., & Kargas, N. (2020). Enhancing resilience in autistic adults using community-based participatory research: A novel HRD intervention in Employment Service Provision. *Advances in Developing Human Resources*, *22*(4), 370–386. https://doi.org/10.1177/1523422320946293

Flanagan, J. C. (1954). The Critical Incident Technique. *Psychological Bulletin, 54*(4), http://www.apa.org/pubs/database/psycinfo/cit-article.pdf

Goering, T. (2021, December 3). *Navy rating ASVAB SCORE requirements*. Navy Cyberspace. Retrieved January 21, 2022, from https://www.navycs.com/asvab-test.html

Goleman, D. (1996). *Emotional intelligence: Why it can matter more than IQ*. Bloomsbury.

Gottfredson, L. S. (1985). Role of self-concept in vocational theory. *Journal of Counseling Psychology, 32*(1), 159–162. https://doi.org/10.1037/0022-0167.32.1.159

Griffith, G. M., Totsika, V., Nash, S., & Hastings, R. P. (2011). 'I just don't fit anywhere': Support experiences and future support needs of individuals with Asperger syndrome in middle adulthood. *Autism*, *16*(5), 532–546. https://doi.org/10.1177/1362361311405223

Hauser, R. M. (2002). Meritocracy, cognitive ability, and the sources of occupational success. Center for Demography and Ecology, University of Wisconsin-Madison.

(CDE Working Paper No. 98-07). https://www.gwern.net/docs/iq/ses/2002-hauser.pdf

Hens, K. (2021). *Towards an ethics of autism: A philosophical exploration*. Open Book Publishers.

Hickey, A., Crabtree, J., & Stott, J. (2017). 'Suddenly the first fifty years of my life made sense': Experiences of older people with autism. *Autism*, *22*(3), 357–367. https://doi.org/10.1177/1362361316680914

Hill, E. L. (2014). Linking clinical and industrial psychology: autism spectrum disorder at work. *Industrial and Organizational Psychology*, *7*(1), 152–155. https://doi.org/10.1111/iops.12125

Hill, W. D., Davies, G., Liewald, D. C., McIntosh, A. M., & Deary, I. J. (2016). Age-dependent pleiotropy between general cognitive function and major psychiatric disorders. *Biological Psychiatry*, *80*(4), 266–273. https://doi.org/10.1016/j.biopsych.2015.08.033

Hoekstra, R. A., Vinkhuyzen, A. A., Wheelwright, S., Bartels, M., Boomsma, D. I., Baron-Cohen, S., Posthuma, D., & van der Sluis, S. (2011). The construction and validation of an abridged version of the autism-spectrum quotient (AQ-short). *Journal of Autism and Developmental Disorders*, *41*(5), 589–596. https://doi.org/10.1007/s10803-010-1073-0

Holland, J. L. (1996). Exploring careers with a typology: What we have learned and some new directions. *American Psychologist*, *51*(4), 397–406. https://doi.org/10.1037/0003-066x.51.4.397

Holland, J. L., & Gottfredson, G. D. (1976). Using a typology of persons and environments to explain careers: Some extensions and clarifications. *The Counseling Psychologist*, *6*(3), 20–29. https://doi.org/10.1177/001100007600600306

Hurlbutt, K., & Chalmers, L. (2004). Employment and adults with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities*, *19*(4), 215–222. https://doi.org/10.1177/10883576040190040301

Hurley, R. S., Losh, M., Parlier, M., Reznick, J. S., & Piven, J. (2007). The broad autism phenotype questionnaire. *Journal of Autism and Developmental Disorders*, *37*(9), 1679–1690. https://doi.org/10.1007/s10803-006-0299-3

Ingersoll, B., Hopwood, C. J., Wainer, A., & Brent Donnellan, M. (2011). A comparison of three self-report measures of the Broader Autism Phenotype in a non-clinical sample. *Journal of Autism and Developmental Disorders*, *41*(12), 1646–1657. https://doi.org/10.1007/s10803-011-1192-2

International Atomic Energy Agency (2013). *Managing human performance to improve nuclear facility operation*. IAEA Publishing. Retrieved from: International Atomic Energy Agency

Jarrold, C. & Roth, D. A. (1998). Is there really a link between engineering and Autism? A reply to Baron-Cohen et al., *Autism, 2*(3), 281-289. https://doi.org/10.1177/1362361398023006

Jennings, N. C., (2021). Standardizing the process for promoting engineers in nuclear power generation to management positions: Why values, attitudes, and interests matter. *Organization Development Review, 53*(5), 50-59.

Jia, R., Steelman, Z. R., & Jia, H. H. (2019). Psychometric assessments of three self-report autism scales (AQ, RBQ-2A, and SQ) for general adult populations. *Journal of Autism and Developmental Disorders*, *49*(5), 1949–1965. https://doi.org/10.1007/s10803-019-03880-x

Johnston, S. (2012). *The Neutron's children: Nuclear engineers and the shaping of identity*. Oxford University Press.

Jordan, C. J., & Caldwell-Harris, C. L. (2012). Understanding differences in neurotypical and autism spectrum special interests through internet forums. *Intellectual and Developmental Disabilities*, *50*(5), 391–402. https://doi.org/10.1352/1934-9556-50.5.391

Joyner, F. F., Mann, D. T. Y., & Harris, T. (2012). Engineering as a social activity: preparing engineers to thrive in the changing world of work. *American Journal of Engineering Education (AJEE)*, *3*(1), 67–82. https://doi.org/10.19030/ajee.v3i1.6890

Kakridas, P. (2020, November 10). *This nuclear professional helps fellow veterans transition to jobs in Energy*. Nuclear Energy Institute. Retrieved January 22, 2022, from https://www.nei.org/news/2020/navy-veteran-connects-fellow-vets-energy-jobs

Kane, R. C. (2004). A possible association between fetal/neonatal exposure to radiofrequency electromagnetic radiation and the increased incidence of autism spectrum disorders (ASD). *Medical Hypotheses*, *62*(2), 195–197. https://doi.org/10.1016/s0306-9877(03)00309-8

Kanner L. (1943). Autistic disturbances of affective contact. *Nervous Child* **2**, 217-250 http://simonsfoundation.s3.amazonaws.com/share/071207-leo-kanner-autistic-affective-contact.pdf

Kanner, L. (1949). Miniature textbook of feeblemindedness. *Pediatrics*, *4*(5), 708–709. https://doi.org/10.1542/peds.4.5.708a

Kevles, D. J. (1968). Testing the army's intelligence: Psychologists and the military in World War I. *The Journal of American History*, *55*(3), 565. https://doi.org/10.2307/1891014

Khemlani, S., & Johnson-Laird, P. N. (2012). Theories of the syllogism: A meta-analysis. *Psychological Bulletin*, *138*(3), 427–457. https://doi.org/10.1037/a0026841

Kitada, A. (2016). Public opinion changes after the Fukushima Daiichi Nuclear Power Plant Accident to nuclear power generation as seen in continuous polls over the past 30 Years. *Journal of Nuclear Science and Technology*, *53*(11), 1686–1700. https://doi.org/10.1080/00223131.2016.1175391

Kulasinghe, K., Whittingham, K., & Mitchell, A. E. (2021). Mental health, broad autism phenotype and psychological inflexibility in mothers of young children with autism spectrum disorder in Australia: A cross-sectional survey. *Autism*. https://doi.org/10.1177/1362361320984625

Lai, M.C., & Baron-Cohen, S. (2015). Identifying the lost generation of adults with autism spectrum conditions. *The Lancet Psychiatry*, *2*(11), 1013–1027. https://doi.org/10.1016/s2215-0366(15)00277-1

Leung, S. A. (2008) The Big Five Career Theories. In: Athanasou J.A., Van Esbroeck R. (eds) International Handbook of Career Guidance. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-6230-8_6

Lewton, M., Ashwin, C., & Brosnan, M. (2018). Syllogistic reasoning reveals reduced bias in people with higher autistic-like traits from the general population. *Autism*, *23*(5), 1311–1321. https://doi.org/10.1177/1362361318808779

Li, S., Rincon, R., & Williams, J. (2017). Climate control: Gender and racial bias in engineering? *2017 ASEE Annual Conference & Exposition Proceedings*. https://doi.org/10.18260/1-2--28038

Lin, G., Cui, Y., Zeng, J., Huang, L. (2020). The effect of autistic traits on social orienting in typically developing individuals. Frontiers in Psychology 11, 794. doi: 10:3389/fpsyg.2020.00794

Little, M. P., Goodhead, D. T., Bridges, B. A., & Bouffler, S. D. (2013). Evidence relevant to untargeted and transgenerational effects in the offspring of irradiated parents. *Mutation Research/Reviews in Mutation Research*, *753*(1), 50–67. https://doi.org/10.1016/j.mrrev.2013.04.001

Lodi-Smith, J., Rodgers, J. D., Cunningham, S. A., Lopata, C., & Thomeer, M. L. (2018). Meta-analysis of Big Five personality traits in autism spectrum disorder. *Autism*, *23*(3), 556–565. https://doi.org/10.1177/1362361318766571

Loomes, R., Hull, L., & Mandy, W. P. (2017). What is the male-to-female ratio in autism spectrum disorder? A systematic review and meta-analysis. *Journal of the*

American Academy of Child & Adolescent Psychiatry, *56*(6), 466–474. https://doi.org/10.1016/j.jaac.2017.03.013

Lord, C., Rutter, M., Goode, S., Heemsbergen, J., Jordan, H., Mawhood, L., & Schopler, E. (1989). Austism diagnostic observation schedule: A standardized observation of communicative and social behavior. *Journal of Autism and Developmental Disorders*, *19*(2), 185–212. https://doi.org/10.1007/bf02211841

Lorenz, T., & Heinitz, K. (2014). Aspergers – different, not less: Occupational strengths and job interests of individuals with Asperger's syndrome. *PLoS ONE*, *9*(6). https://doi.org/10.1371/journal.pone.0100358

LR Gordon, Incorporated. (2014). Critical Incident Technique, Training workbook.

Maenner, M. J., Shaw, K. A., Bakian, A. V., Bilder, D. A., Durkin, M. S., Esler, A., Furnier, S. M., Hallas, L., Hall-Lande, J., Hudson, A., Hughes, M. M., Patrick, M., Pierce, K., Poynter, J. N., Salinas, A., Shenouda, J., Vehorn, A., Warren, Z., Constantino, J. N., DiRienzo, M., … Cogswell, M. E. (2021, December 2). *Prevalence and characteristics of autism spectrum disorder among children aged 8 years - Autism and Developmental Disabilities Monitoring Network, 11 sites, United States, 2018*. Centers for Disease Control and Prevention. Retrieved December 4, 2021, from https://www.cdc.gov/mmwr/volumes/70/ss/ss7011a1.

Manouilenki, I., & Bejerot, S. (2015). Sukhareva-Prior to Asperger and Kanner. *Nordic Journal of Psychiatry, 69*(6), 1761-1764. https://doi.org/10.3109/08039488.2015.1005022

Mason, D., & Happé, F. (2022). The role of alexithymia and autistic traits in predicting quality of life in an online sample. *Research in Autism Spectrum Disorders*, *90*, 101887. https://doi.org/10.1016/j.rasd.2021.101887

Mayer, J. L. (2016). The relationship between autistic traits and atypical sensory functioning in neurotypical and ASD adults: A spectrum approach. *Journal of Autism and Developmental Disorders*, *47*(2), 316–327. https://doi.org/10.1007/s10803-016-2948-5

Milner, V., McIntosh, H., Colvert, E., Happé, F. (2019). A qualitative exploration of the female experience of autism spectrum disorder. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-019-03906-4

Milton, D. E. M. (2012). On the ontological status of autism: The 'double empathy problem.' *Disability & Society*, *27*(6), 883–887. https://doi.org/10.1080/09687599.2012.710008

Modabbernia, A., Velthorst, E., & Reichenberg, A. (2017). Environmental risk factors for autism: An evidence-based review of systematic reviews and meta-analyses. *Molecular Autism*, *8*(1). https://doi.org/10.1186/s13229-017-0121-4

Müller, E., Schuler, A., Burton, B. A., & Yates, G. B., (2003). Meeting the vocational support needs of individuals with Asperger syndrome and other autism spectrum disabilities. *Journal of Vocational Rehabilitation, 18*(3), 163-175. https://www.researchgate.net/publication/285761859_Meeting_the_vocational_support_needs_of_individuals_with_Asperger_Syndrome_and_other_autism_spectrum_disabilities

National Center for O*NET Development. Interests: Realistic, Investigative, Conventional. *O*NET OnLine*. Retrieved December 14, 2021, from https://www.onetonline.org/explore/interests/Realistic/Investigative/Conventional/?i=&z=4

National Science Foundation. (2021, January). *National Survey of College Graduates*. National Science Foundation.gov. Retrieved January 17, 2021, from https://www.nsf.gov/statistics/srvygrads/

Naval Sea Systems Command. (n.d.). *Nuclear Power School*. Naval Sea Systems Command. Retrieved January 21, 2022, from https://www.navsea.navy.mil/Home/NNPTC/powerschool.aspx

Newell, D. (2002). The smarter they are the harder they fail. *Career Development International*, *7*(5), 288–291. https://doi.org/10.1108/13620430210440127

Nishiyama, T., Taniai, H., Miyachi, T., Ozaki, K., Tomita, M., & Sumi, S. (2009). Genetic correlation between autistic traits and IQ in a population-based sample of twins with autism spectrum disorders (ASDS). *Journal of Human Genetics*, *54*(1), 56–61. https://doi.org/10.1038/jhg.2008.3

Nordsletten, A. E., Larsson, H., Crowley, J. J., Almqvist, C., Lichtenstein, P., & Mataix-Cols, D. (2016). Patterns of nonrandom mating within and across 11 major psychiatric disorders. *JAMA Psychiatry*, *73*(4), 354. https://doi.org/10.1001/jamapsychiatry.2015.3192

Nuclear Regulatory Commission. (2020, March 20). *High radiation doses.* nrc.gov. Retrieved January 11, 2022, from https://www.nrc.gov/about-nrc/radiation/health-effects/high-rad-doses.html

Nuclear Regulatory Commission. (2020b, March 20). *Radiation exposure and cancer.* nrc.gov. Retrieved January 11, 2022, from https://www.nrc.gov/about-nrc/radiation/health-effects/rad-exposure-cancer.html

Nuclear Regulatory Commission. (2020c, June 8). *Frequently asked questions*. nrc.gov. Retrieved January 13, 2022, from https://www.nrc.gov/about-nrc/radiation/related-info/faq.html

Nuclear Regulatory Commission. (2020d, November 25). *What is nuclear energy?* nrc.gov. Retrieved January 19, 2022, from https://www.nrc.gov/reading-rm/basic-ref/students/what-is-nuclear-energy.html

Nuclear Regulatory Commission. (2020e, March 19). *What is a chain reaction? | nrc.gov*. Nuclear Regulatory Commission. Retrieved January 19, 2022, from https://www.nrc.gov/reading-rm/basic-ref/students/science-101/what-is-a-chain-reaction.html

Nuclear Regulatory Commission. (2020f, March 19). *What is nuclear fuel? | nrc.gov*. Retrieved January 20, 2022, from https://www.nrc.gov/reading-rm/basic-ref/students/science-101/what-is-an-nuclear-fuel.html

Nuclear Regulatory Commission. (n.d.). *NRC Science 101: What is ionizing radiation?* nrc.gov. Retrieved January 24, 2022, from https://www.nrc.gov/docs/ML1829/ML18290A915.pdf

Nuclear engineer demographics and statistics in the US. Zippia. (2021, December). Retrieved February 8, 2022, from https://www.zippia.com/nuclear-engineer-jobs/demographics/

Parajuli, R. P., Fujiwara, T., Umezaki, M., & Watanabe, C. (2013). Association of Cord blood levels of lead, arsenic, and zinc with neurodevelopmental indicators in newborns: A birth cohort study in Chitwan Valley, Nepal. *Environmental Research*, *121*, 45–51. https://doi.org/10.1016/j.envres.2012.10.010

Parish-Morris, J., Liberman, M. Y., Cieri, C., Herrington, J. D., Yerys, B. E., Bateman, L., Donaher., J., Ferguson, E., Panday, J., & Schultz, R. T. (2017). Linguistic camouflage in girls with autism spectrum disorder. *Molecular Autism*, *8*(1). https://doi-org.zeus.tarleton.edu/10.1186/s13229-017-0164-6

Paul, S., Arora, A., Midha, R., Vu, D., Roy, P. K., & Belmonte, M. K. (2021). Autistic traits and individual brain differences: functional network efficiency reflects attentional and social impairments, structural nodal efficiencies index systemising and theory-of-mind skills. *Molecular autism*, *12*(1), 3. https://doi.org/10.1186/s13229-020-00377-8

Pennebaker Conglomerates, Inc. (n.d.). *Understanding LIWC Summary Measures*. LIWC. Retrieved May 30, 2022, from https://www.liwc.app/help/liwc#Analytical-Thinking

Piven, J., & Sasson, N. J. (2014). On the misapplication of the broad autism phenotype questionnaire in a study of autism. *Journal of Autism and Developmental Disorders*, *44*(8), 2077–2078. https://doi.org/10.1007/s10803-014-2076-z

Piven, J., Palmer, P., Jacobi, D., Childress, D., & Arndt, S. (1997). Broader autism phenotype: Evidence from a family history study of multiple-incidence autism families. The American Journal of Psychiatry, 154(2), 185–190. https://doi.org/10.1176/ajp.154.2.185

Pons, D. (2015). Relative importance of professional practice and engineering management competencies. *European Journal of Engineering Education*, *41*(5), 530–547. https://doi.org/10.1080/03043797.2015.1095164

Posar, A., Resca, F., & Visconti, P. (2015). Autism according to diagnostic and statistical manual of mental disorders 5th edition: The need for further improvements. *Journal of Pediatric Neurosciences*, (2). https://doi.org/10.4103/1817-1745.159195

Power, R. A., & Pluess, M. (2015). Heritability estimates of the big five personality traits based on common genetic variants. *Translational Psychiatry*, *5*(7). https://doi.org/10.1038/tp.2015.96

Precin, P. (2010). The use of visual imagery to enhance sequencing of work tasks. *Work*, *36*(4), 373–379. https://doi.org/10.3233/wor-2010-1040

Punshon, C., Skirrow, P., & Murphy, G. (2009). The `not guilty verdict'. *Autism*, *13*(3), 265–283. https://doi.org/10.1177/1362361309103795

Rensselaer Polytechnic Institute. (2018). *Research reports*. A Blood Test for Autism. Retrieved January 22, 2022, from https://research.rpi.edu/research-report/blood-test-autism

Roelfsema, M. T., Hoekstra, R. A., Allison, C., Wheelwright, S., Brayne, C., Matthews, F. E., & Baron-Cohen, S. (2011). Are autism spectrum conditions more prevalent in an information-technology region? A school-based study of three regions in the Netherlands. *Journal of Autism and Developmental Disorders*, *42*(5), 734–739. https://doi.org/10.1007/s10803-011-1302-1

Rosen, N. E., Lord, C., & Volkmar, F. R. (2021). The diagnosis of autism: From Kanner to DSM-III to DSM-5 and beyond. *Journal of Autism and Developmental Disorders*, *51*(12), 4253–4270. https://doi.org/10.1007/s10803-021-04904-1

Rossignol, D. A., Genuis, S. J., & Frye, R. E. (2014). Environmental toxicants and autism spectrum disorders: A systematic review. *Translational Psychiatry*, *4*(2). https://doi.org/10.1038/tp.2014.4

Rottmann, C., Sacks, R., & Reeve, D. (2014). Engineering leadership: Grounding leadership theory in engineers' professional identities. *Leadership*, *11*(3), 351–373. https://doi.org/10.1177/1742715014543581

Rubenstein, E., & Chawla, D. (2018). Broader autism phenotype in parents of children with autism: A systematic review of percentage estimates. *Journal of Child and Family Studies*, *27*(6), 1705–1720. https://doi.org/10.1007/s10826-018-1026-3

Rubenstein, E., Edmondson Pretzel, R., Windham, G. C., Schieve, L. A., Wiggins, L. D., DiGuiseppi, C., Olshan, A. F., Howard, A. G., Pence, B. W., Young, L., & Daniels, J. (2017). The broader autism phenotype in mothers is associated with increased discordance between maternal-reported and clinician-observed instruments that measure child autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *47*(10), 3253–3266. https://doi.org/10.1007/s10803-017-3248-4

Ruzich, E., Allison, C., Smith, P., Watson, P., Auyeung, B., Ring, H., & Baron-Cohen, S. (2015). Measuring autistic traits in the general population: A systematic review of the autism-spectrum quotient (AQ) in a nonclinical population sample of 6,900

typical adult males and females. *Molecular Autism*, *6*(1), 2. https://doi.org/10.1186/2040-2392-6-2

Sasson, N. J., Faso, D. J., Parlier, M., Daniels, J. L., & Piven, J. (2014). When father doesn't know best: Selective disagreement between self-report and informant report of the Broad Autism Phenotype in parents of a child with autism. *Autism Research*, *7*(6), 731–739. https://doi.org/10.1002/aur.1425

Shindler, A. E., Hill-Yardin, E. L., Petrovski, S., Bishop, N., & Franks, A. E. (2020). A preliminary study of pharmacogenetic biomarkers for individuals with autism and gastrointestinal dysfunction. *Research in Autism Spectrum Disorders*, *71*, 101516. https://doi.org/10.1016/j.rasd.2020.101516

Silberman, S. (2001, December 1). *The geek syndrome*. Wired. Retrieved January 16, 2022, from https://www.wired.com/2001/12/aspergers/

Smith, A. K., & Weiner, C. (1995). *Robert Oppenheimer, letters and recollections*. Stanford University Press.

Soke, G. N., Maenner, M. J., Christensen, D., Kurzius-Spencer, M., & Schieve, L. A. (2018). Prevalence of Co-occurring Medical and Behavioral Conditions/Symptoms Among 4- and 8-Year-Old Children with Autism Spectrum Disorder in Selected Areas of the United States in 2010. *Journal of autism and developmental disorders*, *48*(8), 2663–2676. https://doi.org/10.1007/s10803-018-3521-1

Spradley, J. L. (2019). Nuclear power. *Salem Press Encyclopedia of Science.*

Stacy, R. N. M. (2020). Armed Services Vocational Aptitude Battery (ASVAB). *Salem Press Encyclopedia.*

Standards for Protection Against Radiation, 10 C.F.R. § 20.1201 (1991).

Tang, D., Li, T.-yu, Liu, J. J., Zhou, Z.-jun, Yuan, T., Chen, Y.-hui, Rauh, V. A., Xie, J., & Perera, F. (2008). Effects of prenatal exposure to coal-burning pollutants on children's development in China. *Environmental Health Perspectives*, *116*(5), 674–679. https://doi.org/10.1289/ehp.10471

The Virtual Nuclear Tourist. (2010, June 24). Engineering in nuclear power plants. Retrieved January 19, 2022, from http://www.nucleartourist.com/operation/engineering.htm

Thornton, I. M. (2006). Out of time: A possible link between mirror neurons, autism and electromagnetic radiation. *Medical Hypotheses*, *67*(2), 378–382. https://doi.org/10.1016/j.mehy.2006.01.032

Tomchek, S. D., & Dunn, W. (2007). Sensory processing in children with and without autism: A comparative study using the short sensory profile. *The American Journal of Occupational Therapy*, *61*(2), 190–200. https://doi.org/10.5014/ajot.61.2.190

Trevis, K. J., Brown, N. J., Green, C. C., Lockhart, P. J., Desai, T., Vick, T., Anderson, V., Pua, E. P., Bahlo, M., Delatycki, M. B., Scheffer, I. E., & Wilson, S. J. (2020). Tracing autism traits in large multiplex families to identify endophenotypes of the broader autism phenotype. *International Journal of Molecular Sciences*, *21*(21), 7965. https://doi.org/10.3390/ijms21217965

Trevisan, D., & Birmingham, E. (2015). Examining the relationship between autistic traits and college adjustment. *Autism*, *20*(6), 719–729. https://doi.org/10.1177/1362361315604530

U. S. Bureau of Labor Statistics. (2021, September 8). *Nuclear engineers: Occupational outlook handbook*. U.S. Bureau of Labor Statistics. Retrieved January 17, 2022, from https://www.bls.gov/ooh/architecture-and-engineering/nuclear-engineers.htm

U. S. Census Bureau. (2021, October 8). *Veterans*. Census.gov. Retrieved January 23, 2022, from https://www.census.gov/topics/population/veterans.html

U. S. Department of Energy. (1994) History of nuclear energy. [Pamphlet] retrieved form: https://www.energy.gov/sites/prod/files/The%20History%20of%20Nuclear%20Energy_0.pdf

Verma, A. (2021). The nuclear, humanities, and social science nexus: Challenges and opportunities for speaking across the disciplinary divides. *Nuclear Technology*, *207*(9), iii-xv. https://doi.org/10.1080/00295450.2021.1941663

Volkmar, M.D., Cohen, D. J., & Paul, R. (1986). An evaluation of DSM-III criteria for infantile autism. *Journal of the American Academy of Child Psychiatry*, *25*(2), 190–197. https://doi.org/10.1016/s0002-7138(09)60226-0

Vonnegut, K., (1952). *Player piano.* Delacorte Press.

Walsh, E. J. (1981). Resource mobilization and citizen protest in communities around Three Mile Island. *Social Problems*, *29*(1), 1–21. https://doi.org/10.1525/sp.1981.29.1.03a00010

Waterhouse, L. (2013). *Rethinking autism: Variation and complexity*. Academic Press.

Welkom bij Het Nederlands Autisme Register. Nederlands Autisme Register - Home. (2021). Retrieved January 27, 2022, from https://www.nederlandsautismeregister.nl/

Wellock, T. R. (2021). Social scientists in an adversarial environment: The Nuclear Regulatory Commission and Organizational Factors Research. *Nuclear Technology*, 1–16. https://doi.org/10.1080/00295450.2020.1826273

Wheelwright, S., & Baron-Cohen, S (2001). The link between autism and skills such as engineering, maths, physics and computing: a reply to Jarrould and Routh. *Autism: The International Journal of Research and Practice, 5*(2), 223-227.

Wolfe, A. J. (2013, December 1). Review of *The Neutron's Children: Nuclear Engineers and the Shaping of Identity*. *Physics Today*, *66*(12), 48–48. Retrieved from https://physicstoday.scitation.org/doi/10.1063/PT.3.2215.

World Nuclear Association. (2022, January). *Nuclear Power in the World Today*. Nuclear Power Today | Nuclear Energy - World Nuclear Association. Retrieved January 19, 2022, from https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx

Xie, S., Karlsson, H., Dalman, C., Widman, L., Rai, D., Gardner, R. M., Magnusson, C., Sandin, S., Tabb, L. P., Newschaffer, C. J., & Lee, B. K. (2020). The familial risk of autism spectrum disorder with and without intellectual disability. *Autism Research*, *13*(12), 2242–2250. https://doi.org/10.1002/aur.2417

Yafai, A.-F., Verrier, D., & Reidy, L. (2013). Social conformity and autism spectrum disorder: A child-friendly take on a classic study. *Autism*, *18*(8), 1007–1013. https://doi.org/10.1177/1362361313508023

Yoshimura, S., Kobayashi, K., Ueno, T., Miyagi, T., Oishi, N., Murai, T., Fujiwara, H. (2020). Autistic traits are associated with the functional connectivity of between—but not within—attention systems in the general population. *BMC Neuroscience, 21*(49). https://doi.org/10.1186/s12868-020-00603-2

Yuen, C. R. K., Merico, D., Bookman, M., Howe, L. J., Thiruvahindrapuram, B., Patel, R. V., Whitney, J., Deflaux, N., Bingham, J., Wang, Z., Pellecchia, G., Buchanan, J. A., Walker, S., Marshall, C. R., Uddin, M., Zarrei, M., Deneault, E., D'Abate, L., Chan, A. J., … Scherer, S. W. (2017). Whole genome sequencing resource identifies 18 new candidate genes for autism spectrum disorder. *Natural Neuroscience*, *20*(4):602-611. doi: 10.1038/nn.4524

Zhao, J., Song, J., Li, X., & Kang, J. (2020). A study on EEG feature extraction and classification in autistic children based on singular spectrum analysis method. *Brain and Behavior*, *10*(12). https://doi.org/10.1002/brb3.1721

APPENDIX

Link to survey hosted by Qualtrics

https://tarleton.az1.qualtrics.com/jfe/preview/SV_0PVjBqZ5jquBJ6S?Q_CHL=preview&Q_SurveyVersionID=current

Added AQ questions:

7. Other people frequently tell me what I've said is impolite, even though I think it is polite.

33. When I talk on the phone, I'm not sure when it's my turn to speak.

38. I'm good at social chit-chat.

39. People often tell me that I keep going on and on about the same thing.

44. I enjoy social occasions.

NHS National Institute for Health Research

AQ-10

Autism Spectrum Quotient (AQ)

A quick referral guide for adults with suspected autism who do not have a learning disability.

Please tick one option per question only:		**Definitely Agree**	**Slightly Agree**	**Slightly Disagree**	**Definitely Disagree**
1	I often notice small sounds when others do not				
2	I usually concentrate more on the whole picture, rather than the small details				
3	I find it easy to do more than one thing at once				
4	If there is an interruption, I can switch back to what I was doing very quickly				
5	I find it easy to 'read between the lines' when someone is talking to me				
6	I know how to tell if someone listening to me is getting bored				
7	When I'm reading a story I find it difficult to work out the characters' intentions				
8	I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant etc)				
9	I find it easy to work out what someone is thinking or feeling just by looking at their face				
10	I find it difficult to work out people's intentions				

SCORING: Only 1 point can be scored for each question. *Score 1 point for Definitely or Slightly Agree on each of items 1, 7, 8, and 10. Score 1 point for Definitely or Slightly Disagree on each of items 2, 3, 4, 5, 6, and 9.* If the individual scores **6 or above**, consider referring them for a specialist diagnostic assessment.

This test is recommended in 'Autism: recognition, referral, diagnosis and management of adults on the autism spectrum' (NICE clinical guideline CG142). www.nice.org.uk/CG142

Key reference: Allison C, Auyeung B, and Baron-Cohen S, (2012) *Journal of the American Academy of Child and Adolescent Psychiatry* 51(2):202-12.

UNIVERSITY OF CAMBRIDGE

autism research centre arc