Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

INTROVERSION VS EXTROVERSION

Do you like to make small talk? Do you prefer one-to-one conversations or group activities? These questions and many others often show up in personality quizzes to reveal how introverted or extroverted you are, but what does that really mean? Here's what science tells us about extroversion and introversion.

**What Are Extroversion and Introversion?**

Extroversion and introversion (E/I) are recognized as core aspects of people's personalities. Today, they are included as part of a number of different [personality scales](http://io9.com/5893107/the-many-ways-science-has-incorrectly-assessed-your-personality), including the ever-popular [Myers-Briggs Type Indicator](http://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/) and the [Big Five Aspects Scales](http://ipip.ori.org/BFASKeys.htm), but the idea of E/I goes back nearly a century.

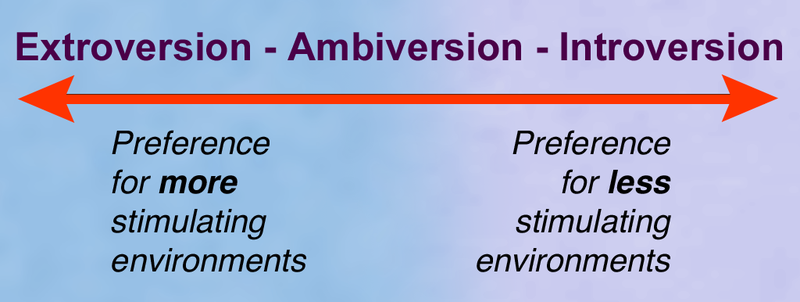
[**The Many Ways Science Has (Wrongly) Assessed Your Personality**](http://io9.com/5893107/the-many-ways-science-has-incorrectly-assessed-your-personality)**:**

What if someone could figure out your personality without actually taking the time to talk to you?

In the 1920s, noted psychologist Carl Jung coined the terms "introverted" and "extroverted" in his 1920s work, *[Psychologische Typen](http://psychclassics.yorku.ca/Jung/types.htm" \t "_blank)*(*Psychological Types*). In his model, differences between the personalities basically boil down to energy: Extroverted people are energized by social interactions, whereas those same engagements are energetically taxing for introverts. So after attending a party or other social gathering, introverts need time alone to "recharge."

Extroverts are typically thought of as those people who are outspoken, outgoing and predominately concerned with what's going on with the outer world. Introverts, by contrast, are quiet, reflective and focused on the inner (mental) world. However, E/I is often seen as a kind of continuum, with people exhibiting a mix of introverted and extroverted tendencies — ["ambiverts" fall somewhere in the middle of this continuum](http://www.ncbi.nlm.nih.gov/pubmed?cmd=Retrieve&list_uids=16367029&dopt=AbstractPlus).

Even Jung didn't think people could be completely introverted or extroverted. "There is no such thing as a pure introvert or extrovert," [he reportedly said](http://www.fastcompany.com/3016100/leadership-now/whos-more-productive-introverts-or-extroverts). "Such a person would be in the lunatic asylum."



Several decades ago, German psychologist Hans Eysenck came up with a more [biologically based model for E/I](http://www.amazon.com/Biological-Basis-Personality-Hans-Eysenck/dp/1412805546?tag=io9amzn-20&ascsubtag=61fb0e159691a15aee9660adbd3463ad0f58b041&rawdata=%5Br%7Chttps%3A%2F%2Fwww.google.com%2F%5Bt%7Clink%5Bp%7C1282059791%5Ba%7C1412805546%5Bau%7C455873096). According to Eysenck's theory, the behaviors of introverts and extroverts are due to differences in [cortical arousal](http://psycnet.apa.org/psycinfo/1991-98456-006) (the speed and amount of the brain's activity). Compared with extroverts, introverts have naturally high cortical arousal, and may process more information per second. This means, essentially, that if you put introverts into an environment with a lot of stimulation, such as a [loud restaurant](http://io9.com/the-greatest-science-fiction-themed-bars-and-restaurant-512256764), they will quickly become overwhelmed or overloaded, causing them to sort of shut down to stop the influx of information. Because of this fact, introverts tend to avoid such active environments. Extroverts, on the other hand, are only minimally aroused, so they seek out highly stimulating environments to augment their arousal levels.

Other theories for E/I also exist. One prominent idea stresses the involvement of people's [brain reward systems](http://www.sciencedirect.com/science/article/pii/0005796770900690), suggesting that extroverts' brains are [more sensitive to rewards](http://www.ncbi.nlm.nih.gov/pubmed/11301519) — such as those inherent in social interactions — than introverts' brains. This sensitively leads extroverts to gravitate towards certain situations and events.

**Different Brains**

Given that some theories behind E/I invoke a neurobiological explanation, scientists have long tried to find experimental evidence for these theories. And let's be clear: There have been [*tons* of neuroscience studies](http://samsnyder.com/2012/04/17/the-neuroscience-of-extraversion-and-introversion/) conducted on E/I over the years, many of which show that the brains of introverts and extroverts really are different.

Back in 1999, scientists measured the [cerebral blood flow of introverted and extroverted people](http://www.ncbi.nlm.nih.gov/pubmed/9989562) with positron emission tomography (PET) scans while they thought freely. They found that the introverts had more blood flow in their[frontal lobes](http://en.wikipedia.org/wiki/Frontal_lobe) and anterior thalamus — brain regions involved with recalling events, making plans and solving problems. Extroverts had more blood flow in brain areas involved with interpreting sensory data, including the anterior cingulate gyrus, the [temporal lobes](http://en.wikipedia.org/wiki/Temporal_lobe) and the posterior thalamus. The data suggested —as Jung believed — that the extroverts' attention focused outwards and the introverts' attention focused inwards.

Research has also shown [that introverts have more neuronal activity](http://www.sciencedirect.com/science/article/pii/S0191886997000275) than extroverts in brain regions associated with learning, motor control and vigilance control, and that their [premotor cortexes process external stimuli more quickly](http://www.ncbi.nlm.nih.gov/pubmed/18400680" \t "_blank). Various studies have [supported Eysenck's arousal model of E/I](http://www.sciencedirect.com/science/article/pii/S0191886900002117) — the research shows that the reticular activating system (RAS), which is responsible for regulating arousal, has [higher basal activity for introverts than for extroverts](http://www.ncbi.nlm.nih.gov/pubmed/18036080). Interestingly, the "[lemon juice experiment](http://www.bbc.co.uk/science/humanbody/mind/articles/personalityandindividuality/lemons.shtml)" also lends credence to the arousal theory. The RAS responds to all types of stimuli, including food — because introverts have increased RAS activity, [they salivate more](http://psycnet.apa.org/index.cfm?fa=search.displayRecord&UID=1965-02004-001) in response to lemon juice.

At the same time, other research shows that there's something to the [reward theory of E/I](http://www.sciencedirect.com/science/article/pii/S0926641005002880). In a study published earlier this year, [researchers gave participants Ritalin](http://www.frontiersin.org/Human_Neuroscience/10.3389/fnhum.2013.00288/abstract), a drug that stimulates the release of the chemical dopamine, which is involved in reward and motivation. While on Ritalin, the participants watched videos showing random nature scenes. After three days, the scientists took away the drug, and then had the participants watch videos in the lab again — the extroverts were excited by the videos, while the introverts were not. [LiveScience explains](http://www.livescience.com/37427-extroverts-have-different-brain-processes.html): The results suggest that Ritalin's effects on the dopamine system didn't translate into reward or motivation for the introverts. That suggests that introverts have a fundamental difference in how strongly they process rewards from their environment, with the brains of introverts weighing internal cues more strongly than external motivational and reward cues, the researchers write in the paper.

Studies have also suggested that the brains of [extroverts pay more attention to human faces than the brains of introverts](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3129862/). In fact, researchers have found that the brains of introverts respond to faces in a similar way that they respond to images of flowers, whereas the extroverts' brains show a stronger response to faces — this suggests that human faces, or people in general, hold more significance to extroverts (which, perhaps, partially explains why they seek out other people's company).

**Abstraction and Risk-Taking**

Our personality is part of what makes us who we are, so it's not so surprising that our levels of introversion and extroversion have wide ranging effects on our lives, including on everything from our language to our risk-taking behaviors to our mental health and happiness.

In terms of language, research has suggested that extroverts and introverts speak differently. Specifically, [extroverts talk more abstractly, while introverts talk more concretely](http://jls.sagepub.com/content/32/2/191), at least when it comes to describing things. Researchers had participants describe (out loud) what was going on in different photos, and found that introverts were more precise in their descriptions.

But when it comes to learning a second language, [extroverts may have the upper hand](http://www.consortiacademia.org/index.php/ijrsll/article/view/42) because they are more likely to "take their existing language system to the limit." Unlike their quiet counterparts, extroverts more readily use what they learn and engage in conversations both inside and outside the classroom — they have more risk-taking behavior.

That risk-taking behavior extends to other areas of life. For example, researchers have found that [risky sexual behavior, such as having unprotected sex, is associated with "sensation seeking,"](http://www.ncbi.nlm.nih.gov/pubmed/15695196) a trait that is related to high extroversion. People with personalities that are low in conscientiousness but high in extroversion or neuroticism are also more likely to be the ones getting [involved with high-risk sports, including paragliding and skydiving](http://www.ncbi.nlm.nih.gov/pubmed/21268472). Additionally, research has linked high extroversion (and high self-esteem, which may be [influenced by extroversion](http://www.sciencedirect.com/science/article/pii/S0191886903000801)) with [adolescent smoking](http://www.ncbi.nlm.nih.gov/pubmed/15296680).

Scientists have found numerous other behavioral traits that are influenced by E/I. In 1990, a study suggested that [extroverts wear more decorative clothing, whereas introverts are more practical in their clothing choice](http://psycnet.apa.org/psycinfo/1981-26914-001). More recently, researchers found that unlike introverts, extroverts tend to [go for immediate gratification](http://www.ncbi.nlm.nih.gov/pubmed/21038955) and pass up on potential future opportunities.

Perhaps one of the most important (and consistent) findings in E/I research is that [extroverts are happier overall than introverts](http://www.sciencedirect.com/science/article/pii/019188699090157M), and this [increased happiness lasts for decades](http://www.sciencedirect.com/science/article/pii/S0092656613000901). Scientists have struggled to pinpoint the cause of extroverts' happiness, though they are certainly not without ideas.

Researchers have proposed that extroverts may feel greater happiness than introverts [because they are more sensitive to rewarding social situations](http://www.ncbi.nlm.nih.gov/pubmed/11519937) (as seen above). On the other hand, others have suggested that extroverts are happier because [they engage in *more* social activities](http://www.sciencedirect.com/science/article/pii/019188699090128E). Some scientists think that extroverts' perpetual happiness stems from their [greater mood regulation abilities](http://onlinelibrary.wiley.com/doi/10.1111/j.1467-6494.2006.00405.x/abstract). Or maybe they're happy because they hold on tightly to [all of those good memories.](http://www.sciencedirect.com/science/article/pii/S0191886911000961)

At the same time, however, scientists have questioned whether extroverts really are happier, or if they're just [more declarative with their feelings](http://www.livescience.com/15655-extrovert-responses-personality-surveys.html). There's also the issue of how, exactly, you [define and measure "happiness."](http://www.psychologytoday.com/blog/quiet-the-power-introverts/201112/are-extroverts-happier-introverts-yes) Whatever the case, extroverts and introverts likely [benefit from different happiness increasing strategies](http://www.scirp.org/journal/PaperInformation.aspx?PaperID=26228), given the inherent differences in the personality types.

In a recent [book on introversion](http://www.amazon.com/Quiet-Power-Introverts-World-Talking/dp/0307352153?tag=io9amzn-20&ascsubtag=31de41f4b711f1f0010f82063775afc36966ce3a&rawdata=%5Br%7Chttps%3A%2F%2Fwww.google.com%2F%5Bt%7Clink%5Bp%7C1282059791%5Ba%7C0307352153%5Bau%7C455873096), author Susan Cain explains that although introverts make up a third to a half of the population, Western society — the United States, in particular — is extroversion-centric. She notes that [schools and workplaces are designed for extroverts](http://www.cnn.com/2012/03/18/opinion/cain-introverts-power/), under the belief that collaboration is key to creativity and productivity (the opposite of which is true for introverts). What's more, extroverted traits, such as being a gregarious "people person," are highly valued in today's society, and this can make introverts feel like something is wrong with them (and perhaps, make the unhappy). She calls for a new system that gives introverts the solitude they need to thrive.

Questions:

1. Who coined the terms introvert and extrovert?
2. Where do EXTROVERTS get their energy?
3. Where do INTROVERTS get their energy?
4. What areas of the brain show more activity in EXTROVERTS?
5. What areas of the brain show more activity in INTROVERTS?
6. What did the Ritalin experiment suggest?
7. What types of behavior, both good and bad, have studies linked to EXTROVERTS?
8. Do you agree with the notion that extroverts are happier people? Explain your reasoning.
9. What did you learn from the TED talk with Susan Cain about the nature of introverts?
10. Do you consider yourself an introvert, an extrovert, on an ambivert? Explain your answer.