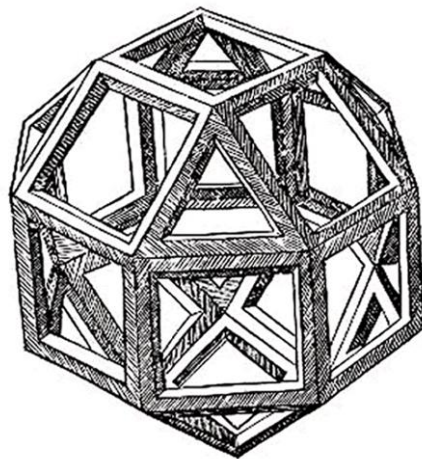# Everything is connected

exploring diversity, innovation, leadership

Zeger Van Hese, 2014

Z-sharp bvba

Knee-deep in the cosmic overwhelm, I'm stricken
by the ricochet wonder of it all: the plain

everythingness of everything, in cahoots
with the everythingness of everything else.

~ Diane Ackerman ~

Image on cover page:

Rhombicuboctahedron by Leonardo Da Vinci

(from: De divina proportione, Luca Pacioli, 1509)

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Intro (duction)

Paul Gerrard, gentle host of the Eurostar Conference this year, challenged me. He challenged me good. Initially I was asked to deliver "Testing in the age of distraction", my presentation from last year, but Paul got second thoughts and later on suggested that maybe I could do something around the conference theme, give my take on it.

"Think about it." He said. "And oh, by the way, there's one more thing... I need to have your title and abstract by tomorrow. Bye now".

Frantic thinking ensued. Diversity, innovation and leadership were the three concepts that Paul wanted as the cornerstone of the conference, and they were intriguing enough - two years ago I even centered this very conference on innovation. The way Paul stated the theme suggested three independent, separate entities - hence the commas in-between - but my gut was telling me otherwise. I felt that they are connected, belong together in a way. I wanted to find out how, learn more, and immerse myself in the subject. Then and there, I wrote "everything is connected", started exploring the theme and decided to document my search as I went along.

This was a different approach for me. But I guess that sometimes you have to jump off a cliff and develop wings on the way down.

Intro (spection)

The day after I confirmed the talk, reality kicked in. I started wondering why I intuitively assumed a connection in the theme and went with it. Where did that crazy idea come from? But then I realized that I have a tendency to think in connections and analogies: I find great joy in discovering connections between seemingly unrelated things and in hindsight, lots of stories on my blog are about that. It appears to be systemic to my personality, so I decided to revisit my Myers-Briggs personality type. I'm an ENFP, if you're familiar with that classification system. Here's a small excerpt from the ENFP description:

> "More than just sociable people-pleasers though, ENFPs are shaped by their Intuitive quality, allowing them to read between the lines with curiosity and energy. They tend to see life as a big, complex puzzle where everything is connected - but unlike Analysts, who tend to see that puzzle as a series of systemic machinations, ENFPs see it through a prism of emotion, compassion and mysticism, and are always looking for a deeper meaning. If they've found a cause that sparks their imagination, ENFPs will bring an energy that oftentimes thrusts them into the spotlight, held up by their peers as a leader and a guru - but this isn't always where independence-loving ENFPs want to be." [1]

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[1] Source: http://www.16personalities.com/enfp-personality

That hit home in a weird way. Apparently, my "everything is connected" gut feeling has something to do with the combination of extraversion and intuition, called the "Extraverted Intuition" function, the "EN part" that both ENFPs and ENTPs have. So I dug deeper into that.

> "The Extraverted Intuition type has the ability to make obscure connections.
> They can take two seemingly unrelated topics and bring them together.
> This can also cause them to have an off-beat sense of humor." [2]

Granted, maybe this was a little bit more than I needed to know. A couple of weeks later, I stumbled upon another quote that resonated with me:

> "Principles for the Development of a Complete Mind:
> Study the science of art. Study the art of science. Develop your senses.
> Especially, learn how to see. Realize that everything connects to everything else"

That quote was attributed to Leonardo Da Vinci. [3]

The problem with quotes on the Internet is that it is hard to verify their authenticity - I believe Abraham Lincoln said that. Verifying the authenticity was indeed hard in this case, because I searched for the original source, examined all of Leonardo's notebooks - which are all available online on the Gutenberg Project site,[4] but couldn't find this particular quote. Whether he wrote this particular piece of text or not, Leonardo Da Vinci did write a lot about the interconnectedness of all things and phenomena - systems thinking. In fact, he was one of the original systems thinkers.[5]

This made me wonder about Leonardo's personality profile. I entered "Leonardo Da Vinci" + MBTI as a search string in Google, and a list of famous ENTP types – Leonardo included - was the first hit. His main personality trait: Extraverted Intuition, yet again.[6]

The Tribar

Months have past since my initial commitment and my exploration of the theme took me to unforeseen places: poetry, astrophysics, anthropology, drawing, linguistics, music, weird patents, politics and an amount of research papers that forced me to upgrade my Dropbox account to Pro. What I found is that diversity, innovation and leadership are indeed strongly connected.
I am a visual/spatial learner, which means I usually have to draw things in order to understand them and learn about them. A lot of sketching and re-sketching happened along the way, a kind of exploratory drawing for sense making. Triangles were emerging everywhere.

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[2] Source: http://personalitygrowth.com/extraverted-intuition/
[3] Source: http://www.barnesandnoble.com/w/leonardos-notebooks-leonardo-da-vinci/1100489530?ean=9781603763370
[4] Source: http://www.gutenberg.org/ebooks/5000
[5] Fritjof Capra, 2012, How Leonardo Da Vinci solved problems with systems thinking
http://videos.huffingtonpost.com/how-leonardo-da-vinci-solved-problems-with-systems-thinking-517311542
[6] Source: http://www.celebritytypes.com/entp.php

The Theme Tribar

This is a Penrose triangle, a tribar, named after the psychologist who popularized it in the fifties. It is a classic example of an impossible object, a spatial paradox. I chose it because it illustrates how the central concepts are tangled and intertwined, but at the same time contain paradoxical elements.

I also discovered that there is one concept that ties the three together. More on that later; let's talk about diversity first.

Diversity

Diverse diversities

When I asked Paul how he saw diversity in the theme, he told me his initial idea was "diversity in the systems we test", which I found quite intriguing since I always found diversity to have a people ring to it. I wanted to get a grip on that people side of diversity first, but the more I tried, the more confused I got. What kind of diversity should I focus on?

Should I focus on *biodiversity*, which is responsible for the amazing variation of life on our planet? Or maybe I should focus on *cultural diversity*, which manifests itself through all the different languages spoken in the world? All these languages are different ways of seeing the world, and all are equally adequate as modes of expression for the people who use them.
This linguistic diversity is responsible for beautifully untranslatable words like:
- "Iktsuarpok", an Inuit word for the feeling of anticipation when you're waiting for someone to show up at your house and you keep going outside to see if they're there yet.
- "Mamihlapinatapai", which is Yagan, the language spoken on Tierra del Fuego and considered one of the hardest words to translate. It means as much as "When two people

look at each other and silently but desperately urge the other confess or act upon something they both desire, but neither will."

- The German "Torschlusspanik". Literally, this means "gate-closing panic", but it usually means "the fear of diminishing opportunities as one ages." I can relate to that.
- The Japanese "Tsundoku": "The act of leaving a book unread after buying it, typically piled up together with other such unread books". Tsundoku is my middle name.

And what about absurd words like hippopotomonstrosesquipedaliophobia - the fear of long words?[7] Imagine hearing that diagnosis spoken out loud by your doctor - the horror!

At the beginning of this century, there were something like 7000 spoken languages on Earth. Now there are closer to 6000, and every two weeks or so the last speaker of yet another spoken language dies. As that language vanishes, a way of interpreting and explaining the world does too, since that's what languages are for.[8] [9] This kind of diversity is on the verge of extinction.

Linguistic diversity also manifests itself in the testing language, reflecting different ways of seeing, explaining and interpreting testing phenomena in different contexts across the world. This richness of language is a reality, and I believe an asset rather than something that can be standardized.

What kind of diversity should I focus on? I turned to dictionaries to get some clarity on the matter. Most of the definitions agree on diversity as the quality of being diverse or different. And that quality of being different from one another is central to our existence. It's a paradox, really: we all stem from one forefather, we are all human beings and we all share a human experience, but at the same time we are also uniquely different: we have a unique DNA, and unique fingerprints.[10] Apart from these unique identifiers, we differ from one another in many other dimensions: gender, age, ethnicity, race, national origin, sexual orientation, socio-economic class, religious beliefs, political beliefs, culture, ability, personality type, the generation we're part of, the things that we're good at, the things that we love to do, et cetera.

The diversity wheel below illustrates that diversity is much more than just the surface qualities of race or gender. It encompasses all qualities that make us unique, as an individual or as part of a group. The funny thing is that diversity in itself is a very diverse and multidimensional concept. In fact, diversity is like one of those Matryoshkas, Russian nesting dolls: once we crack one layer, there's always another, like a fractal, exponentially granular with each layer. Due to that infinite

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[7] Source: http://phobias.about.com/od/phobiasatoh/a/Hippopotomonstrosesquipedaliophobia.htm
[8] Wade Davis, 2003, dreams of endangered cultures, TED Talk
[9] Michael Bolton, 2011, "If It's Not Context-Driven, You Can't Do It Here.", CAST 2011 Keynote - http://www.developsense.com/presentations/2011-08-CAST-ContextDrivenTesting.pdf
[10] Helen Turnbull, 2013, Inclusion, Exclusion, Illusion and Collusion, TED Talk

fractal progression, no attempt to address diversity could ever hope to be complete.[11] We are more than just one identity: human diversity is multidimensional.
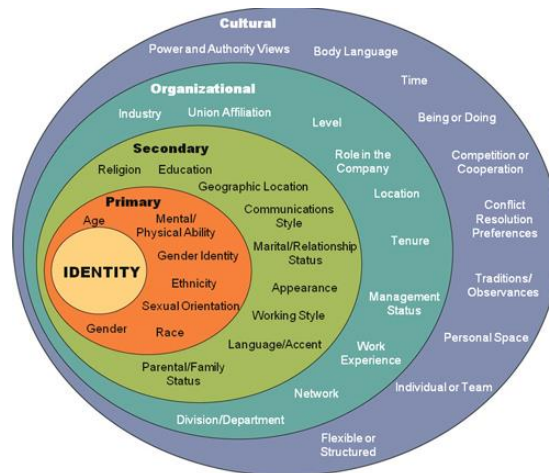
Source: Kornferry Institute, Dimensions of diversity[12]

The one million dollar question here is of course: is this diversity a blessing or a curse? Are two heads better than one, or do too many cooks spoil the broth? I'll come back to this later.

Requisite variety

Diversity matters in testing, I think, mostly because of a phenomenon called "Requisite variety". This was first coined by Ross Ashby in 1956, in his "Law of Requisite Variety".[13]

The "Law of Requisite Variety" states that, when you want to control a system, your control system must be at least as complicated as the system you are controlling. In other words, in order to deal properly with the diversity of problems the world throws at you, you need to have a repertoire of responses which is (at least) as nuanced as the problems you face.[14] We say that a "system" only has "requisite variety" if its repertoire of responses is at least as big as the number of different stimuli it may encounter in its environment. A system without requisite variety will fail whenever it encounters the unexpected (testing, anyone?) and as such is not a viable system.[15]

This diagram is a bit of a simplification, but it illustrates the concept quite well:

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[11] Maria Popova, 33 Books on How to Live: My Reading List for the Long Now Foundation's Manual for Civilization - http://www.brainpickings.org/2014/03/14/manual-for-civilization-reading-list/
[12] Source: http://www.kornferryinstitute.com/institute-blog/2012-11-07/understanding-many-dimensions-diversity
[13] Ross Ashby, 1956, An Introduction to Cybernetics
[14] Source; http://requisitevariety.co.uk
[15] Thompson, 2007, The law of requisite variety and team agility - http://www.bioteams.com/2007/10/22/the_law_of.html#more
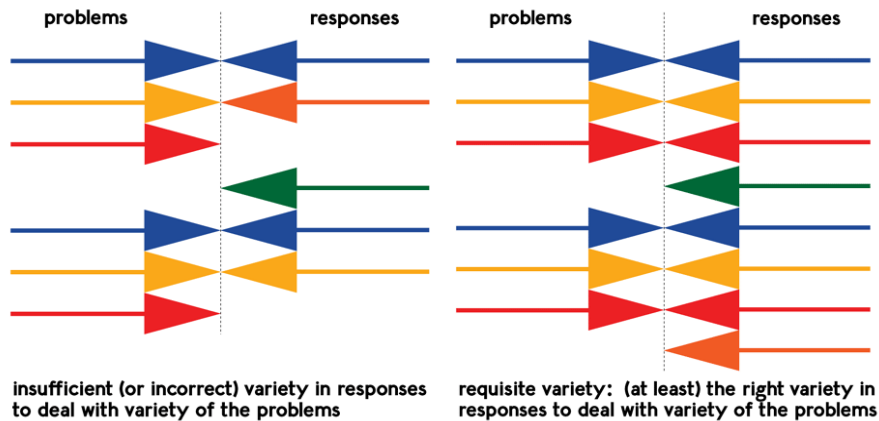
Source: requisitevariety.co.uk

Here's a more practical example: imagine you are driving a car, and the road ahead twists and turns sharply. If you have some kind of lock on your steering wheel so you can only turn it a little bit, you're going to run off the road, because you don't have enough variety in your controls: you can't turn it enough in order to erase the variety that has been created by the winding road. But if you can turn your wheel enough, you have requisite variety since you can apply such measures as are necessary to keep the state of the car within its target set.[16]

Ashby himself summarized it with "only variety can master variety", or "only variety can destroy variety".[17]

I will focus on two kinds of diversity that have the potential of providing us with requisite variety when testing: team diversity and diversity of test ideas.

Team diversity

Obstacles to team diversity

First I would like to highlight a couple of obstacles to achieving diversity in a team:
- Affinity bias. We have a tendency to surround ourselves with people who think like us.
- Social comparison bias: we favor those we consider to be in 'our group'.
This is also called the "comfortable clone" syndrome: we tend to hire coworkers that share similar interests and training. Eventually, this results in everyone thinking alike.

Here are a couple of ways to achieve requisite variety in your teams:

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[16] James Bach, 2013, A-galumphing we go, Testbash
[17] The W. Ross Ashby Digital Archive, http://www.rossashby.info/index.html, 1953, Volume 18, page 4659

Hiring variety in

In the late nineties, in full Y2K frenzy, my previous employer was recruiting much needed testers. They were casting a wide net, to increase their chances - testing was booming and the resources were lacking. They ended up taking anything they could get - including me, by the way. I ended up in teams with people from different professional and educational backgrounds: historians, physicists, economists, biologists, marketers, people majoring in Germanic languages, young IT graduates... all shapes and sizes, and a wide age range. This could have gone wrong in so many ways, but in hindsight, these were the best teams I've ever been on. Sure, most of the team members weren't technical, but they were eager to learn and their unique problem-solving skills blend more than made up for that.

Later on, because of the economic situation and wage pressure, they changed their hiring policy for testers. They started focusing solely on school-leavers, young IT graduates, for testing positions. They ended up hiring mainly white male IT graduates in their twenties, because that happened to be the main demographic of their target group. I am aware that it is a fractal and if you drill down in this group you *will* find differences, but this is not a good starting point if you want your team to have requisite variety. This was affinity bias at work.

I have sinned against this myself, in the past. In assembling my team I found myself favoring like-minded people. I went for the road of least resistance - and for the increased risk of groupthink.

The thing is, if you build in diversity in your team, each one of your team members will lack some skills, but the team as a whole will have them all. And the broader the range of cultural and experiential backgrounds, the more diverse ways they will analyze the software and the more problems they will find.

This leads me to believe that diversity is a critical asset in testing, not something to be avoided.

Designing variety in

Apart from hiring or choosing people with different backgrounds, a human team can achieve requisite variety by designing it in, through amplification and attenuation:[18]
- Amplification is where the team sets up cooperation with other agents in its external environment to amplify its ability to respond to events. For example a tester on-site at a customer is a way for the central test team to amplify its responses to a given customer. Managers use amplification by delegating tasks and providing training.
- To attenuate means to reduce the magnitude or force of something. Attenuation in this context means, through sampling, reducing the number of signals the system has to listen to. Test managers use attenuation when they by exception reporting and "managing by walking around".

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[18] Raul Espejo, 2003, The viable system model - a briefing about organisational structure

Requisite variety & management - Control dilemmas

What does this team variety mean for the people who have to control such a team? Management usually has lower variety than the teams they control, so they cannot possibly maintain awareness of all that is going on within them. At the same time, management knows that they are accountable for any loss of control. The anxiety to know more frequently leads to increased demands for special reports, extra metrics et cetera. Does this sound familiar to the testers? And does this sound familiar to the managers in the audience? Be careful, though. What this demand for extra information does, in reality, is reduce the variety of the team, making the team less flexible as they struggle to fulfil the managers wishes at the expense of carrying out their own work. But because of the law of requisite variety, management can never win with this type of control strategy.[19]

Diversity of opinion - diversity makes your team wiser as a group

In his 2005 book "The Wisdom of Crowds", James Surowiecki stated that diversity is important because it preserves independence of opinion, which is needed for a collectively wise group

> *"Diversity contributes to a team not just by adding different perspectives to the group but also by making it easier for individuals to say what they really think. Independence of opinion is both a crucial ingredient in collectively wise decisions and one of the hardest things to keep intact. Because diversity helps preserve that independence, it's hard to have a collectively wise group without it."* [20]

Diversity of ideas

I would also like to highlight another form of diversity, very test-specific: the diversity of test ideas/test strategy.

Randomness & serendipity

> *"Chance favors the prepared mind"*
> *- Louis Pasteur -*

It is a good idea to add randomness to our testing. Randomness is an important enabler of variety, which might lead you to unexpected finds. And in case you're a hunter, unexpected foods: some African tribes start each day's hunt by effectively spinning a "sacred stick" to make a random choice of hunting direction. If they did not do this they would be at a constant risk of

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[19] Raul Espejo, 2003, The viable system model - a briefing about organisational structure, p19-20
[20] James Surowiecki, The Wisdom of Crowds, 2005

"over hunting" certain territories which had been successful in the past and missing out on new but unexpected food sources[21].

Adding more variety in your strategy increases the chances at serendipity, "finding something valuable when looking for something else, thanks to an observant mind".[22] We have to be prepared for it, have the right mindset, but the key is to make good judgments when serendipity crosses our path.

Shmuel Gershon described a brilliant example of serendipity and lateral thinking in action in his 2011 blog post "The Big Exploratory Testing Rolling Strategy Dice".[23] The concept is very simple: he rolls two dice, one with 6 product coverage areas and another - 12-sided - die with quality characteristics. He then uses whatever combination the rolling of the dice produced to inspire his testing.

Diversity in mindset (focus|defocus)

To test effectively, we need to be able to switch between creative and critical thinking. In other words, managing our focus is a very important skill in testing. To think critically, we need to be focused. To think creatively, we need to embrace defocus.[24]

> *"We must struggle to develop a suspicious nature (focus!)*
> *as well as a lively imagination (defocus!)"*
> Computer programming fundamentals, Weinberg & Leeds, 1961

> *"Whenever I suggest stepping back, easing up, laughing a little at ourselves, and going outside our own field (defocus!), somebody objects, saying: "But software is different. We have to work harder, concentrate more (focus!), because nothing is as complex as software." Well, of course software is different and more complex than anything people have ever before attempted to engineer. But that's why we have to loosen our structures, not tighten them. That's why we must learn from any place we can, any way we can".*
> *(defocus!)*
> Overstructured Management Of Software Engineering, Jerry Weinberg, 1982

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[21] Thompson, 2007, The law of requisite variety and team agility -
http://www.bioteams.com/2007/10/22/the_law_of.html#more
[22] Rikard Edgren, 2014, Good testers are often lucky, Nordic Testing Days
[23] Shmuel gershon, 2011, The Big Exploratory Testing Rolling Strategy Dice, blog post
http://testing.gershon.info/201108/the-big-exploratory/
[24] Zeger Van Hese, 2013, Testing in the Age of Distraction – the Importance of Focus and Defocus in testing

Diverse half-measures

In the 2001 book "Lessons Learned in Software Testing: A Context-Driven Approach", Cem Kaner and James Bach explain the principle of diverse half-measures.[25]

There is no single technique that finds all bugs - we can't do any technique perfectly, nor can we do all conceivable techniques. Therefore, a less thorough, more diversified test strategy is better than a more thorough, less diverse strategy. In other words, it's better to do more different kinds of testing to a pretty good level, than to do one or two kinds of testing perfectly. Maximizing diversity in all dimensions of your testing will let you find more problems and uncover more risks.

Any given test technique may find a lot of bugs at first, but the find-rate curve will eventually flatten out. If you switch to a technique that is sensitive to a different kind of problem, your find rate may well climb again. In terms of overall bug-finding productivity, it is a good idea to perform each technique to the point of sufficiently diminished returns and then switch to a new technique.

This, of course, ties in nicely with the principle of requisite variety as explained earlier: only variety can destroy variety, or, for testing purposes, only variety can explore variety.

Innovation

Deconstructing innovation

It is a general misconception that innovative persons are idea machines, just like it is a misconception that creative persons are great innovators.

While deconstructing innovation, I realized it consists of three different parts: ideation, championing and implementation.

The creativity part:
- **Ideation:**
  Are you able to generate lots of ideas?

The innovation part which requires leadership, or someone taking ownership:
- **Championing:**
  Can you find the resources necessary for idea realization?
- **Implementation:**
  Can you translate fantasy into reality?

You could summarize that as

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[25] Bach, Kaner, Pettichord, 2001, Lessons Learned in Software Testing: A Context-Driven Approach", Lesson 283,

"Innovation is the ability to convert ideas into invoices"
- Lewis Duncan -

Ideation

Every single one of us has creative potential. Unfortunately, the biggest barrier to creativity is our self-imposed limitations. We say things like, "I don't think I am creative, therefore, I am not." We need to get past that and look at ourselves on a creative continuum. When we are developing a new skill, we get better by practicing and doing it more frequently. The same thing is true for developing our "creative muscles." Creativity can be learned, trained and fostered. In the 1950's, researchers like Roger Sperry and Betty Edwards started to do studies on the right side of the brain, which deals with creativity, intuition and non-linear information. They found that, by using techniques to stimulate right brain thinking, a person can learn to be more creative.[26] [27]

Here are a couple of things that I usually do to get my creative juices flowing:
- Defocus. We are most creative when we are relaxed, unfocused, and not trying
to be creative. Think about it - aren't you most creative in the car, in the shower, while gardening, jogging or doing the dishes?
- Unconscious processing. Before diving head-first into a problem, read up on it and take a break. Unconscious processing will do its magic.
- Jolt your routine. About 85% of the average adult's day mental cruise control. Break out of this and do something different!
- Ask a lot of questions: Why? Why Not? What If?
- How would a six-year-old view your project or problem?
- Think of someone you respect for his or her creativity and ask yourself "How can I model or copy their behavior?"

Copying behavior is more common than most people think. Creativity isn't magic. It happens by applying ordinary tools of thought to existing materials. Creativity consists of three basic elements: copy, transform and combine.

Copying is how we learn; we can't introduce anything new until we're fluent in the language of our domain. And we do that through emulation. For instance, all artists spend their early years playing or recording other artists' work. Bob Dylan's first album contained eleven - 11! - cover songs out of thirteen songs in total. Hunter S. Thompson retyped "The Great Gatsby" on his typewriter just to get the feel of writing a great album. Nobody starts out original. We need copying to build a foundation of knowledge and understanding.

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[26] Beich, E. (1996). The ASTD trainer's sourcebook: Creativity and innovation. New York: McGraw Hill
[27] Edwards, Betty (1999). The new drawing on the right side of the brain, Jeremy P. Tarcher/Putnam

It's only after we know the fundamentals that it becomes possible to create something new through *transformation*, taking an idea and creating variations. Contrary to common belief, Thomas Edison didn't invent the light bulb. His first patent was "improvement in electric lamps", but he did produce the first commercially viable one, after trying 6000 different materials for the filament.

But the most dramatic results can happen when ideas are *combined*. By connecting ideas together, creative leaps can be made, producing some of history's biggest breakthroughs. Henry Ford didn't invent the assembly line, interchangeable parts or even the automobile itself. They combined all these elements in 1908 to produce the first mass-market car, the Model T.[28]

It is important to know that "new" ideas usually come from reusing/remixing old ideas. This was a great realization for me. If you start looking around you, you'll see that everything is really a remix.

This idea to re-use other people's ideas sounds like good practice and common sense - until you're the one getting remixed. In 1996, Steve Jobs said: "Picasso had a saying: 'Good artists copy. Great artists steal.' And we have, you know, always been shameless about stealing great ideas".[29] In 2010, his tone changed: "I am going to destroy Android because it's a stolen product. I'm willing to go thermonuclear war on this". So in other words: "Great artists steal, but not from me".[30]

Championing and implementation

Lots of innovations don't look like a big deal, much like modern art, in a way. That is because innovation lies at the end of the creative process. It is the change that occurs as a result of a new idea.

> *"The person who says it cannot be done, should not interrupt the person doing it"*
> *Chinese proverb*

Change does not come by itself, it happens because someone takes the original idea and runs with it.

In 2011, in the Philippines, a man named Mang Demi introduced an ingenious replacement for the household light bulb. He developed water bottles that diffuse solar energy for light where light bulbs are not only scarce, but very expensive. This lean and inexpensive alternative to the common electric light bulb has changed the lives – and lowered electricity bills - in lower and middle-class shanty villages throughout the Philippines. Sure, Mang Demi – who soon earned the

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[28] Kirby Ferguson, 2011, Everything is a remix, documentary
[29] Triumph of the Nerds, 1996, documentary, PBS
[30] Kirby Ferguson, 2012, Embrace the remix, TED talk

nickname of "Mang Demi Solar" – was an innovator. But the solar bottle idea was not new. A Brazilian man named Alfredo Moser came up with this very idea in 2002, 9 years before Mang Demi did. And Moser merely transformed an invention that already existed in boats for a long time: the first British patent for a deck prism was granted to Edward Wyndus in 1684.[31]

The idea was there, Mang Demi ran with it by championing and implementing it.

Diversity and innovation

I mentioned in the beginning that I felt that diversity and innovation were strongly connected and interlaced. When I read the book "Space chronicles – facing the ultimate frontier" by Neil Degrasse Tyson, I was struck by a passage about diversity. 1000 years ago, in the golden age of Islam, the city of Baghdad was the intellectual power house of the world. The main reason for this, he says, was their tolerance of diversity: it didn't matter if you were Jewish, Muslim, Christian or nonbeliever; you were always welcome to bring your ideas to the debating table. And because they embraced the mixing of ideas, they were able to make great advances in farming, medicine, engineering, physics, mathematics and astronomy. Meanwhile, they started gathering all the written wisdom in the world and translating it into Arabic. Did you know that 2/3 of all the named stars have Arabic names? They got naming rights because they charted them better than anybody had done before. Our numbers are Arabic too, as well as many of the mathematical jargon that's still around.[32]

Wait, was all this happening because of diversity? If there's one thing that I took away from last year's Eurostar keynote by Laurent Bossavit, it's that I shouldn't just accept other people's stories, that I should be skeptical and look for evidence. Where's the data?[33]

Back to that million dollar question: is this diversity a blessing or a curse? Are two heads better than one? Or do too many cooks spoil the broth? Is there any data available about the impact of team diversity on the performance of teams?

As it turns out, there is plenty of it.

Paradoxically, there are compelling studies that show that diversity is good for a team – that it leads to better performance, creativity and innovation – while there are equally compelling ones that reach opposite conclusions – that it leads to chaos and friction in the workplace. Nancy Adler's book "International Dimensions of Organizational Behavior" offers an explanation for these contradictions. She reached the same results: the diagram below shows the relative performance on creative tasks of a series of problem-solving teams. You can see that culturally diverse teams

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[31] Source: http://glassian.org/Prism/index.html
[32] Neil Degrasse Tyson, 2012, "Space Chronicles – facing the ultimate frontier", p. 205
[33] Laurent Bossavit, Skeptical Self-Defense For The Serious Tester Or, How To Call A $37 Billion Bluff, Eurostar 2013 keynote

are usually either more or less effective than single-culture teams, but rarely equally effective. Why? She came to the conclusion that the productivity and creativity of a team does not depend on the presence or absence of diversity, but rather on how well diversity is managed.[34]
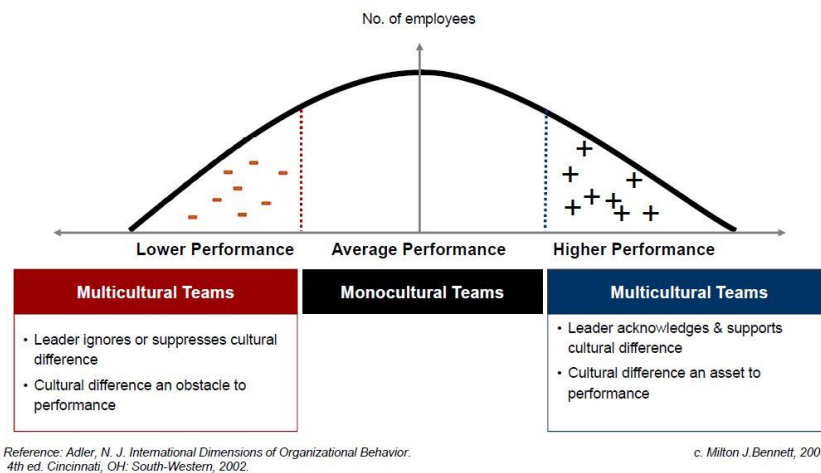
Relative performance on creative tasks of a series of problem-solving teams

Conclusion: greater diversity (not diversity based on gender or ethnicity, but rather diversity of experience), *when managed well*, leads to greater creativity and innovation.[35]

Leadership

Diversity needs leadership

This is where leadership comes into play. When managed well, diversity becomes an asset for the team. When ignored, diversity causes process problems that diminish the performance (not diversity based on gender or ethnicity, but rather intellectual diversity, the diversity of ideas)

Diversity is the mix, and leadership is making the mix work [36]

The trick is to make the mix work, but that is easier said than done. I will come back to this later. Let's focus on leadership first. What *is* leadership, anyway?

Problem-solving leadership: a definition

Few people are comfortable with calling themselves a leader. It seems that we made leadership into something bigger than us: we made it about changing the world, thinking it is something that

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[34] Nancy J. Adler, p. 140, 2008, International Dimensions of Organizational Behavior
[35] Andres Tapia, 2013, The Inclusion Paradox – 2nd edition: The Obama Era and the Transformation of Global Diversity
[36] I am paraphrasing Andres Tapia's "Diversity is the mix, inclusion is making the mix work" from "The Inclusion Paradox – 2nd edtition: The Obama Era and the Transformation of Global Diversity", p. 15

maybe one day we will deserve to achieve, something that comes from above in the form of directives. But leadership is not something that only "leaders" possess. In the context of testing, I like Jerry Weinberg's take on problem-solving leadership:

> "*Leadership is the **process** of **creating an environment** in which people **become empowered (and inspired)** to do **their best work**.*" [37]

This definition implies a couple of things:

- Process: You're not leading people, you're leading the process, leaving the people in control.
- Creating an environment: There is an organizational aspect to leadership. Any change in environment or conditions to facilitate creative problem-solving is an act of leadership. This implies that leadership is not strictly limited to managers or gurus, leadership is something that can be exercised by anyone in the team. I learned from Jerry Weinberg that even getting out of the way can be an act of leadership if this helps the team move forward.
- Empowered: If you leave people in control, this makes them empowered, much like a gardener empowers seeds: not by forcing them to grow, but by tapping the power that lies within them.
- Best work: People delivering their best work will be a direct result of all the previous. People have an urge to get better at stuff. They feel motivated by a sense of mastery. That is why people play musical instruments in the weekend. That's why testers attend tester meet-ups in their free time.

> "*If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea.*" [38]
> - Antoine de Saint-Exupéry -

Inspiration does not come from directives and tasks. People are inspired and motivated by autonomy, opportunity for mastery and the belief that their task is meaningful.[39] Be aware though that there is no cookie-cutter approach to motivating people. What inspires one person may leave the next one cold.

Recognizing good ideas

Another way to facilitate the process of people delivering their best work is recognizing good ideas and supporting them with any means possible. This sounds trivial, but history teaches us that dozens of good ideas were rejected at first:

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[37] Gerald M. Weinberg, 1986, Becoming a Technical Leader: An Organic Problem-Solving Approach. The "inspired" addition is courtesy of Fiona Charles
[38] Paraphrased from Antoine de Saint-Exupéry, 1948, Citadelle
[39] Dan Pink, 2009, Drive: The surprising truth about what motivates us, Ted Talk

- Xerox invented the interface for the personal computer. They failed to see its potential.[40]
- Steve Sasson from Kodak invented the digital camera in 1975, but the executives were afraid that it would hurt their own lucrative film business, so they didn't market it.[41]
- In ancient history, Socrates was against the idea of writing things down in books as a useful means for conveying knowledge. History also shows us that good ideas will prevail in the end.[42]

But why do great ideas get rejected at first? For an idea to be great and innovative, it has to have two qualities: it has to be *new* and it has to be *useful*, and it turns out humans have a terrible time reconciling the two. This is called the status-quo bias. When an idea is new, it's unknown, it threatens the status quo of the old, and it's the old that we use to judge whether or not something is useful. When we attempt to judge a new idea based on the paradigm of the old idea, we end up not seeing the potential in the new.[43]

Perhaps we don't need more creative ideas, perhaps we need to get better at recognizing the great ideas that are being presented to us.

So test team leaders, managers, you have a big responsibility. If you are being presented with great ideas (improvement ideas, test ideas,...), ask yourself: "How am I viewing this idea? Am I being biased? Am I valuing the old at the expense of the new?"

Creative Abrasion

After spending a lot of time inside my mental Tribar, I came to realize that there is one concept central to all this. There is something that ties diversity, innovation and leadership together, and that's creative abrasion, productive conflict that unleashes the power of diversity.

The term creative abrasion was coined by Gerald Hirshberg, director of Nissan Design International[44], and the concept has been further developed by Dorothy Leonard.

Creative abrasion takes place when ideas rub against each other productively, like the sparks that occur when hitting flint on steel.

"Innovation occurs at the boundaries between mindsets,
not within the provincial territory of one's knowledge or skills base" [45]
- Dorothy Leonard -

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[40] Source: http://www.businessinsider.com/xerox-was-actually-first-to-invent-the-pc-they-just-forgot-to-do-anything-with-it-2012-2
[41] Source: http://www.forbes.com/sites/avidan/2012/01/23/kodak-failed-by-asking-the-wrong-marketing-question/
[42] Source: http://www.timeforthought.net/2011/10/socrates-had-objections-to-written.html?m=1
[43] David Burkus, 2013, Why Great Ideas Get Rejected, TED talk
[44] Jerry Hirshberg, 1999, The Creative Priority : Putting Innovation to Work in Your Business, p.34
[45] Dorothy Leonard, 1998, Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation

Innovation occurs at the boundaries between mindsets, when different ideas collide. And that is possible only when you let people work together who see the world in inherently different ways: people with diverse ideas, backgrounds, skills sets, perceptions and experiences. It is disagreeing with the aim of moving forward.

The role of leadership

As I mentioned earlier, if we want to reap the benefits of diversity, we have to make the mix work. The key to this is facilitating and managing the process of creative abrasion, and leadership plays a crucial role in this:

- If you're in charge of assembling a team, select people because of their differences in ideas, biases, personalities, skills and values – not in spite of the differences.
- Encourage people to respect the thinking styles of other team members. All people involved need reassurance that their viewpoints, although opposed, are equally valued.
- The energy generated by the conflict can go both ways, and it's a thin line between productive and destructive conflict. Good leadership channels this energy into creating rather than destroying.
- You need vision and courage to see past this discomfort of temporary conflict to the potential benefits.
- Find and manage the right balance between "Peer Collaboration" and "Creative Abrasion". There is a need for both; the trick is to find the best spot in the problem-solving process for each of them. Creative abrasion is typically needed in the ideation step, when coming up with new ideas, peer collaboration during problem definition and solution-gathering.

Epilogue

In the beginning, I mentioned that my notes and sketches were full of triangles. Here's a final one. I think that - for testing - the diversity/innovation/leadership trinity works like a prism. When white light hits a prism, it refracts into colors that leave the prism at different angles, making the whole color spectrum visible. This spectrum does not appear under all circumstances though. If light inside the prism hits one of the surfaces at a sufficiently steep angle, total internal reflection occurs and all of the light is reflected.[46]

I believe that testing in this context is like the ray of light - if the diversity mix and the leadership conditions are right, testing can disclose its full creative and innovative spectrum:

Diversity, innovation, leadership and testing as a prism

Our testing will be better off if we embrace the power of difference, of variety, of diversity. A diversity of approaches will provide us with requisite variety and make our testing more effective. Intellectual diversity, the diversity of backgrounds and ideas, will allow cross-pollination between different disciplines to happen which in turn will lead to new ideas and novel approaches.

The influence of leadership on diversity and innovation cannot be overestimated.
Creating a mix is one thing, but we also have to facilitate and manage creative abrasion to make that mix work. Leadership is required at all levels. We need it during ideation, both at the source - coming up with good ideas – as well as at the receiving end: spotting good ideas and being open to them. We also need leadership to champion and implement the good ideas of others.

You don't need to be a manager to be a leader. It's all in the details. If you spot people with good ideas, help them get their ideas across and let them realize their best work.
That is true leadership.

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[46] How prisms work, http://en.wikipedia.org/wiki/Prism

References

- Luca Pacioli, 1509, De Divina Proportione
- Diane Ackerman, 1976, The Planets - A Cosmic Pastoral, Poem "Diffraction (for Carl Sagan)"
- MBTI personality types: http://www.16personalities.com/enfp-personality/
- MBTI personality types: http://personalitygrowth.com/extraverted-intuition/
- Leonardo Da Vinci's notebooks: http://www.gutenberg.org/ebooks/5000
- Leonardo Da Vinci quote source: http://www.barnesandnoble.com/w/leonardos-notebooks-leonardo-da-vinci/1100489530?ean=9781603763370
- Fritjof Capra, 2012, How Leonardo Da Vinci solved problems with systems thinking http://videos.huffingtonpost.com/how-leonardo-da-vinci-solved-problems-with-systems-thinking-517311542
- MBTI celebrity personality types: http://www.celebritytypes.com/entp.php
- Information about fobias: http://phobias.about.com/od/phobiasatoh/a/Hippopotomonstrosesquipedaliophobia.htm
- Wade Davis, 2003, dreams of endangered cultures, TED Talk: http://www.ted.com/talks/wade_davis_on_endangered_cultures/
- Michael Bolton, 2011, "If It's Not Context-Driven, You Can't Do It Here", CAST 2011 Keynote: http://www.developsense.com/presentations/2011-08-CAST-ContextDrivenTesting.pdf
- Helen Turnbull, 2013, Inclusion, Exclusion, Illusion and Collusion, TED Talk
- Maria Popova, 33 Books on How to Live: My Reading List for the Long Now Foundation's Manual for Civilization - http://www.brainpickings.org/2014/03/14/manual-for-civilization-reading-list/
- Dimensions of diversity : http://www.kornferryinstitute.com/institute-blog/2012-11-07/understanding-many-dimensions-diversity
- Ross Ashby, 1956, An Introduction to Cybernetics
- Requisite variety: http://requisitevariety.co.uk/what-is-requisite-variety/
- Thompson, 2007, The law of requisite variety and team agility - http://www.bioteams.com/2007/10/22/the_law_of.html#more
- James Bach, 2013, A-galumphing we go, Testbash talk http://www.ministryoftesting.com/2013/04/testbash-video-a-galumphing-we-go-james-bach/
- Ross Ashby notes: the W. Ross Ashby Digital Archive, http://www.rossashby.info/index.html, 1953, Volume 18, page 4659
- Raul Espejo, 2003, The viable system model - a briefing about organisational structure, p19-20
- James Surowiecki, The Wisdom of Crowds, 2005
- Rikard Edgren, 2014, Good testers are often lucky, Nordic Testing Days
- Shmuel gershon, 2011, The Big Exploratory Testing Rolling Strategy Dice, blog post http://testing.gershon.info/201108/the-big-exploratory/
- Zeger Van Hese, 2013, Testing in the Age of Distraction – the Importance of Focus and Defocus in testing

- Bach, Kaner, Pettichord, 2001, Lessons Learned in Software Testing: A Context-Driven Approach", Lesson 283
- Biech, E., 1996, The ASTD trainer's sourcebook: Creativity and innovation. New York: McGraw Hill
- Edwards, Betty, 1999, The new drawing on the right side of the brain, Jeremy P. Tarcher/Putnam
- Kirby Ferguson, 2011, Everything is a remix, documentary
- Triumph of the Nerds, 1996, documentary, PBS
- Kirby Ferguson, 2012, Embrace the remix, TED talk
- Deck prism patent info: http://glassian.org/Prism/index.html
- Neil Degrasse Tyson, 2012, "Space Chronicles - facing the ultimate frontier", p. 205
- Laurent Bossavit, Skeptical Self-Defense For The Serious Tester Or, How To Call A $37 Billion Bluff, Eurostar 2013 keynote
- Nancy J. Adler, p. 140, 2008, International Dimensions of Organizational Behavior
- Andres Tapia, 2013, The Inclusion Paradox – 2nd edition: The Obama Era and the Transformation of Global Diversity
- Catherine Houghtaling, 2010, Leading Change by Developing a Culture of Innovation, Presented at The Chair Academy Conference, March 2010
- Richard T. Pascale, 1990, Managing on the Edge: Companies That Use Conflict to Stay Ahead
- Scott Page, 2007, The Difference: How the power of diversity creates better groups, firms, schools, and societies", Princeton, NJ: Princeton University Press, p. 140
- Corinne Post, Emilio De Lia, November 2009, Capitalizing on thought diversity for innovation: team dynamics can affect innovation both positively and negatively. Here's how to accentuate the positive, Research-Technology Management
- Frank De Wit and Lindred Greer, 2008, The Black-Box Deciphered: A Meta-Analysis Of Team Diversity, Conflict, And Team Performance, Academy of Management Proceeding
- Floor Rink and Naomi Ellemers, 2010, Benefiting from deep-level diversity: How congruence between knowledge and decision rules improves team decision making and team perceptions, Group Processes & Intergroup Relations Vol. 13 Issue 3, May 2010
- Anita Williams Woolley, Christopher F. Chabris, Alexander Pentland, Nada Hashmi, and Thomas W. Malone, 2010, Evidence for a Collective Intelligence Factor in the Performance of Human Groups, Science, September 30, 2010
- Lee Gardenswartz, Anita Rowe, 2003, Diverse Teams at Work: Capitalizing on the Power of Diversity
- Nigel Bassett-Jones, Creativity and Innovation Management, 2005, The Paradox of Diversity Management, Creativity and Innovation. Creativity and Innovation Management, June 2005, Volume 14, Issue 2, Pages 105–204
- Northcraft, Neale, Kramer, 1996, Diversity in work teams: Research paradigms for a changing workforce, American Psychological Association, 1996, Pages 69-79
- Carol Hymowitz, 2005, The New Diversity, The Wall Street Journal, November 2005

- Marie-Élène Roberge and Rolf van Dick, 2010, Recognizing the benefits of diversity: When and how does diversity increase group performance?, Human Resource Management Review, vol. 20, no 4 (December 2010): p. 295-308
- Ricarda Bouncken and Viviane A. Winkler, 2010, National and cultural diversity in transnational innovation teams, Technology Analysis & Strategic Management, vol. 22, no. 2 (February 2010): p. 133-151.
- Cox, T,. & Blake, S., 1991, Managing cultural diversity: Implications for organisational competitiveness. Academy of management executive, 5(3): 45-56.
- Isaksen, S.G., & Lauer, K.J. (2002), The climate for creativity and change in teams. Creativity and innovation management, 11: 74–86.
- Laroche, L., & Rutherford, D. (2006), Recruiting, retaining and promoting culturally different employees. Butterworth-Heinemann.
- Tacheva, S., (2007), Top management team diversity: A multilevel exploration of antecedents and consequences. University of St Gallen, business dissertations p143. Dissertation no 3316 (Gutenberg).
- Watson, B., Spoonley, P., & Fitzgerald, E. (2009), Managing diversity: A twenty-first century agenda. New Zealand Journal of Employment Relations 34(2):61-76.
- Yang, Y. (2005), Developing cultural diversity advantage: The impact of diversity management structures. Academy of management annual meeting proceedings; pH1-H6, 6p
- Gerald M. Weinberg, 1986, Becoming a Technical Leader: An Organic Problem-Solving Approach
- Antoine de Saint-Exupéry, 1948, Citadelle
- Dan Pink, Drive: The surprising truth about what motivates us - Ted Talk
- Rejected innovations by Xerox: http://www.businessinsider.com/xerox-was-actually-first-to-invent-the-pc-they-just-forgot-to-do-anything-with-it-2012-2
- Rejected innovations by Kodak: http://www.forbes.com/sites/avidan/2012/01/23/kodak-failed-by-asking-the-wrong-marketing-question/
- Socrates against writing: http://www.timeforthought.net/2011/10/socrates-had-objections-to-written.html?m=1
- David Burkus, 2013, Why Great Ideas Get Rejected, TED talk
- Jerry Hirshberg, 1999, The Creative Priority : Putting Innovation to Work in Your Business, p.34
- Dorothy Leonard, 1998, Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation
- Wikipedia on how prisms work: http://en.wikipedia.org/wiki/Prism
- Leonard and Swap, 1999, When sparks fly: Igniting creativity in groups
- Scott Berkun, 2007, The Myths of Innovation
- Gerald M. Weinberg, 2001, An Introduction to General Systems Thinking (Silver Anniversary Edition)
- Nora Bateson, 2010, An Ecology of Mind, documentary about Gregory Bateson
- David Foster Wallace on leadership, from "Consider the Lobster and Other Essays", 2007